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Popular Woodworking Magazine

February 2016 ■ #223

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- Rip capacity: 30" R, 12" L
- Approx. shipping weight: 208 lbs.

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- Motor: 2 HP, 120V/240V, prewired 120V, single-phase, 60 Hz
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- Precision-ground cast iron table with wings measures: 40½" W x 27" D
- Table height: 35⅜"
- Footprint: 21" L x 19½" W
- Arbor: ⅝" • Arbor speed: 3450 RPM
- Rip capacity: 30" right, 15" left
- Overall size: 57¼" W x 35⅜" H x 37½" D
- Approx. shipping weight: 348 lbs.

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10" HYBRID TABLE SAW with RIVING KNIFE

- Motor: 2 HP, 110V/220V*, single-phase, prewired to 220V
- Amps: 16A at 110V, 8A at 220V
- Precision-ground cast-iron table
- Measures: 27" D x 40" W
- Table height: 34"
- Footprint: 20" L x 21½" W
- Arbor: ⅝" • Arbor speed: 3850 RPM
- Capacity @ 90°: 3⅛" • Capacity @ 45°: 2³⁄₁₆"
- Rip capacity: 30" right, 12" left
- Overall size: 60" L x 36" W x 40" H
- Approx. shipping weight: 416 lbs.

** Converting to 110V requires purchase of T23999 conversion kit.*

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FREE 10" CARBIDE-TIPPED BLADE

10" 3 HP CABINET LEFT-TILTING TABLE SAWS

- Motor: 3 HP, 240V, single-phase, 3450 RPM, 14A
- Cutting capacity: 8" L, 25⅝" R of blade (G1023RL), 8" L, 53" R of blade (G1023RLX)
- Maximum depth of cut @ 90°: 3"
- Maximum depth of cut @ 45°: 2⅛"
- Extension table: 40" W x 27" D (G1023RLX)
- Base dimension: 20½" x 20½"
- Approx. shipping weight: 550 lbs.

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7' RAILS AND EXTENSION TABLE

G1023RLX ONLY $1625.00

$150 shipping

10" CABINET TABLE SAWS with RIVING KNIFE

- Motor: 3 HP, 220V, single-phase, 12.8A
- Precision-ground cast iron table with extension: 27" x 40" (G0690), 27" x 74¾" (G0691)
- Table height: 34" • Arbor: ⅝"
- Arbor speed: 4300 RPM
- Max. dado width: ¹³⁄₁₆"
- Capacity @ 90°: 3⅛", @ 45°: 2³⁄₁₆"
- Rip capacity: 29½" R, 12" L
- Approx. shipping weight: 530 lbs. (G0690), 557 lbs. (G0691)

WITH RIVING KNIFE

G0690 ONLY $1525.00

WITH RIVING KNIFE AND EXTENSION RAILS

G0691 ONLY $1625.00

FREE 10" CARBIDE-TIPPED BLADE

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6" JOINTERS with BUILT-IN MOBILE BASE

New!

- Motor: 1 HP, 110V/220V, single-phase, 14A/7A
- Prewired voltage: 110V
- Table size: 6⅝" x 47⅜" • Number of knives: 3
- Cutterhead speed: 5000 RPM
- Cutterhead diameter: 2½"
- Maximum depth of cut: ⅛"
- Cuts per minute: 15,000
- Fence size: 29⅛" long x 4" high
- Approx. shipping weight: 262 lbs. (G0813), 259 lbs. (G0814)

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G0813 ONLY $525.00

WITH CABINET STAND

G0814 ONLY $595.00

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8" JOINTERS

- Motor: 3 HP, 240V, single-phase, TEFC, 3450 RPM, 12A
- Precision-ground cast iron table size: 73½" x 9⅜"
- Cutterhead speed: 4800 RPM
- Cutterhead diameter: 3"
- Max. depth of cut: ⅛"
- Max. rabbeting depth: ½"
- Cuts per minute: 19,200 (G0656W), 21,400 (G0656XW)
- Approx. shipping weight: 517 lbs.

BUILT-IN MOBILE BASE

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WITH BUILT-IN MOBILE BASE

G0656W ONLY $875.00

WITH SPIRAL CUTTERHEAD & BUILT-IN MOBILE BASE

G0656XW ONLY $1295.00

$150 shipping

10" JOINTER/PLANER COMBO

GERMAN DESIGNED AND ENGINEERED

- Motor: 2½ HP, 220V, single-phase, 9.9A, 3400 RPM
- Jointer table size: 12½" x 40¹⁵⁄₁₆"
- Cutterhead knives: 2 HSS
- Knife size: 10¼" x ¹¹⁄₁₆" x ⅛"
- Cutterhead diameter: 2³⁄₃₂"
- Cutterhead speed: 6500 RPM
- Max. depth of cut: ⅛" (jointer), ³⁄₁₆" (planer)
- Maximum width of cut: 10¼" (jointer), 9¾" (planer)
- Cuts per minute: 13,000
- Floor-to-table height (jointer): 33¾"
- Overall dimensions: 46" L x 27" W x 38" H
- Approx. shipping weight: 378 lbs.

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- Motor: 3 HP, 240V, single-phase, 12A
- Max. cutting width: 15" • Max. stock thickness: 8"
- Min. stock thickness: 3/16"
- Min. stock length: 8" (G0453W), 6" (G0453ZW)
- Max. cutting depth: 1/8" • Feed rate: 16 and 20 FPM
- Cutterhead diameter: 3" • Cutterhead speed: 5000 RPM
- Power feed rollers: solid serrated steel
- Table size: 41¾" x 16"
- Overall dimensions: 38" W x 42½" H x 42" D
- Approx. shipping weight: 594 lbs. (G0453W), 604 lbs. (G0453ZW)

G0453W ONLY $1195.00

WITH SPIRAL CUTTERHEAD
G0453ZW ONLY $1895.00

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$150 shipping lower 48 states

20" PLANERS

- Motor: 5 HP, 240V, single-phase, 20A
- Table size: 21" x 25¾" (21" x 56½" with wings)
- Max. cutting width: 20" • Min. stock length: 7½"
- Max. cutting depth: 1/8"
- Feed rate: 16 and 20 FPM
- Number of carbide inserts: 96 (G0454ZW)
- Number of knives: 4 HSS (G0454W)
- Knife size: 20" x 1" x 1/8" (G0454W)
- Cutterhead speed: 5000 RPM
- Overall dimensions: 44" W x 56½" D x 43½" H
- Approx. shipping weight: 947 lbs.

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- 3 Interchangeable spindles: ½", ¾", and 1"
- Spindle openings on table: 1¼", 3", 4", and 7"
- Spindle speeds: 7000 and 10,000 RPM
- Approximate shipping weight: 392 lbs.

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14" 12 SPEED HEAVY-DUTY FLOOR DRILL PRESS

- Motor: ¾ HP, 110V, single-phase, 9A • Swing: 14"
- Drill chuck: 1/64"–5/8"
- Drilling capacity: ¾" steel
- Spindle taper: MT#2 • Spindle travel: 3¼"
- Speeds: 140, 260, 320, 380, 480, 540, 980, 1160, 1510, 1650, 2180, 3050 RPM • Collar size: 2.595"
- Precision-ground cast iron table size: 11⅜" square
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- Approx. shipping weight: 171 lbs.

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- Air suction capacity: 775 CFM
- Static pressure at rated CFM: 1.80"
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- Impeller: 13½" steel
- Height: 68"
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- Approx. shipping weight: 210 lbs.

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G0703P ONLY $850.00

30TH ANNIVERSARY 17" 2HP HEAVY-DUTY BANDSAW

- Motor: 2 HP, 110V/220V, single-phase, TEFC, prewired 220V, 1725 RPM
- Amps: 20A at 110V, 10A at 220V
- Precision-ground cast iron table size: 17" x 17" x 1½" thick
- Table tilt: 10° left, 45° right
- Floor-to-table height: 37½"
- Cutting capacity/throat: 16¼" left
- Blade size: 131½" long
- Approx. shipping weight: 342 lbs.

MADE IN AN ISO 9001 FACTORY

G0513ANV ONLY $895.00

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17" HEAVY-DUTY BANDSAW

- Motor: 2 HP, 110V/220V, prewired to 220V, single-phase, TEFC
- Precision-ground cast iron table size: 17" sq.
- Table tilt: 45° R, 10° L
- Cutting capacity/throat: 16¼"
- Max. cutting height: 12⅛"
- Blade size: 131½" L (⅛"–1" W)
- Blade speeds: 1700 & 3500 FPM
- Quick-release blade tension lever
- Approx. shipping weight: 346 lbs.

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14" 1¾ HP DELUXE BANDSAW

- Motor: 1¾ HP, 110V/220V, prewired 110V, single-phase, TEFC, 15A/7.5A
- Table size: 19¾" x 14⅜" x 1½" thick
- Table tilt: 8° left, 45° right
- Floor-to-table height: 42¼"
- Cutting capacity/throat: 13⅜"
- Maximum cutting height: 10"
- Blade width: ⅛"–¾"
- Blade speed: 3000 FPM
- Approx. shipping weight: 284 lbs.

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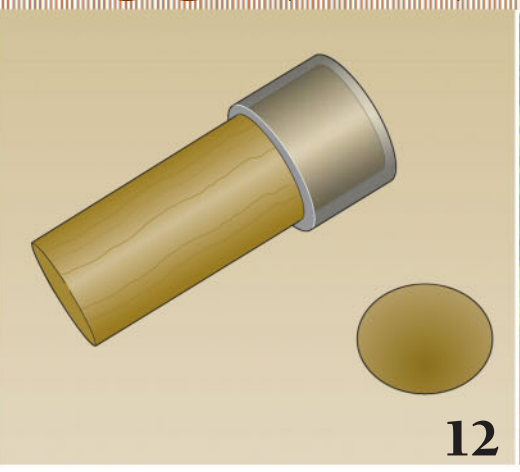

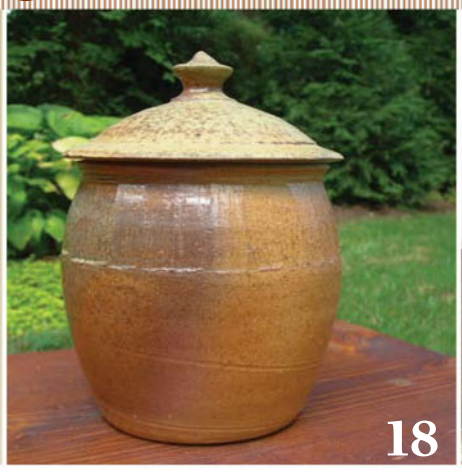

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2016 Queen City Woodworking Fun

I've had to hastily rethink my topic for this editor's note. Just as we were getting ready to sign off on the editorial pages for the issue, we got the signed contract back from the conference site staff for Woodworking in America 2016. So, I'm happy to announce (earlier than has been typical for several years!) that this year's event will be Sept. 16-18 at the Northern Kentucky Convention Center in Covington, Ky., just across the river from downtown Cincinnati.

That weekend is also Oktoberfest Zinzinnati 2016 – the largest Oktoberfest celebration in the United States (and, with 48,000 participants, proud record-holder of the world's largest chicken dance).

In other words, in addition to Sept. 16-18 being a weekend of woodworking fun, friendship and learning, there could be copious amounts of beer involved (even more than usual) – and I would swear on a stack of Shakespeare's First Folios that it's wholly coincidental.

By the time you're reading this, I'll have contacted and signed a dozen (or more) of today's best and best-known woodworkers to join us and teach at the conference. While I don't quite yet know everyone who will be speaking or what they'll be speaking about, I do know that education sessions will run the gamut of all things woodworking.

In 2015, speakers covered topics including sharpening, bench-building basics, approaches to workholding, stringing and inlay, doors and drawers, chair design, gilding, parquetry, handsaws, handplanes, period carving, orthographic drawing, SketchUp for woodworkers and much more.

And while many of this year's sessions will be different, they'll once again offer a wide range of woodworking know-how – from beginner topics to specialty applications and techniques – that you can take home and put to use in your shop. In other words, I'll do my best to make sure there's something – many somethings – for everyone.

And then there's the Marketplace. Have you been lusting after a new dovetail saw? Or perhaps debating between bench planes? Or maybe you need a new marking knife but don't know which style is best suited to your hands and work? The Woodworking in America conference is the place to find out – you can get your hands on these tools and more, and try them out before you buy.

But perhaps best of all is the camaraderie – you can spend three days talking about nothing but woodworking, and no one will think that's weird. In fact, it's encouraged. **PWM**

P.S. The conference is also just 7 miles from my house – I mention it in case you've a hankering to stay after for a few days to help with plumbing, framing, electric...or whatever wee house rehab project I'm up to by that point.

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popularwoodworking.com
EDITORIAL OFFICES 513-531-2690

VICE PRESIDENT & GROUP PUBLISHER ■ Jamie Markle
jamie.markle@fwcommunity.com, x11452

GROUP EDITORIAL DIRECTOR & EDITOR ■ Megan Fitzpatrick
megan.fitzpatrick@fwcommunity.com, x11348

SENIOR ART DIRECTOR ■ Daniel T. Pessell
daniel.pessell@fwcommunity.com, x11596

SENIOR MANAGING EDITOR ■ Michael Wallace
mike.wallace@fwcommunity.com, x11407

CONTRIBUTING EDITORS ■ Bob Flexner, Christopher Schwarz, Steve Shanesy

PHOTOGRAPHER ■ Al Parrish

PROJECT ILLUSTRATOR ■ Donna R. Hill

ONLINE CONTENT DEVELOPMENT MANAGER ■ David Thiel
david.thiel@fwcommunity.com, x11255

ONLINE CONTENT DEVELOPER ■ Jacob Motz
jacob.motz@fwcommunity.com, x11005

CONTENT EDITOR, BOOKS ■ Scott Francis
scott.francis@fwcommunity.com, x11327

F+W, A Content + eCommerce Company

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331 N. Arch St., Allentown, PA 18104
TEL. 610-821-4425; FAX. 610-821-7884
d.schroder@verizon.net

ADVERTISING SALES COORDINATOR ■ Connie Kostrzewa
TEL. 715-445-4612 x13883
connie.kostrzewa@fwcommunity.com

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For newsstand sales, contact Scott T. Hill:
scott.hill@procirc.com

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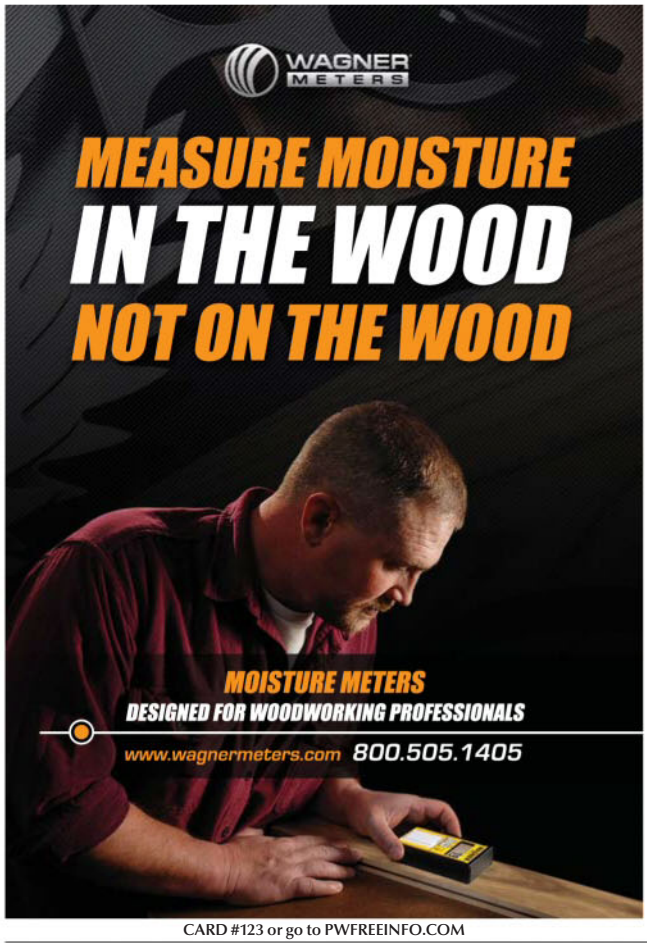

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Trimming a Holdfast Cuts Holding Ability

I am building the "21st-century Workbench" by Robert W. Lang featured in the October 2008 issue of *Popular Woodworking Magazine* (#171).

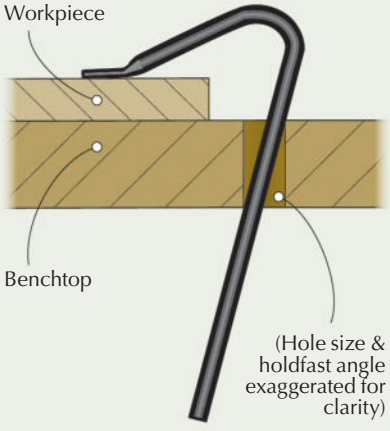
My question regards the cross holes in the front of the benchtop; I assume they are for securing a board in a vertical position. How deep are these holes drilled?

It seems my choices are to drill holes 6" deep or cut off some of the shaft of each of my holdfasts. What would you suggest?

I am also concerned about my benchtop being "honeycombed."

Although I have been woodworking for many years, I have never built a nice workbench like this and I don't want to screw it up.

Tom Jackson,
via e-mail



Tom,

The holes on the front edge of the benchtop (which, were it me building this bench, I would drill before laminating that piece to the glue-up) are about 2" deep (i.e. through one lamination); those are for 3/4"-diameter wooden pegs you might insert to help hold a piece on edge in the twin-screw vise for edge planing or what have you. Those aren't intended to house holdfasts. If you don't want to make wooden pegs, Lee Valley bench pups (leevalley.com) would also fit.

In any case, you wouldn't want to cut down a holdfast–these devices need to go through the top and wedge at an angle to hold the workpiece tight to the bench (to loosen, whack the back of it). If you cut them short and/or they don't go all the way through, they won't work.

In the design presented in that article, the holes in no way undermine the strength of the top.

Megan Fitzpatrick, editor

Will Wax Protect Shellac?

I've read that you can prevent white water rings in a shellac finish by applying a coat of wax. Is this true?

James Murray,
Chicago, Illinois

James,

The short answer is that wax adds no significant protection, and anyway, shellac doesn't watermark until it's very old.

Shellac was almost the only finish used on furniture between the 1820s and 1920s, after which lacquer replaced it. Shellac on furniture from this era is now very old and deteriorated, and it watermarks fairly easily (other finishes also watermark when they age). This has led to shellac's bad reputation.

However, freshly dissolved and applied shellac is virtually impossible to watermark without the added application of heat. Note "freshly dissolved."

Shellac becomes more susceptible to watermarking the longer it sits in a container before being applied as a finish. You're safer dissolving your own shellac from flakes than using already-dissolved shellac in cans because you don't know how old it is.

I think it was Zinsser that initially spread the instruction of applying paste wax to prevent watermarking (the marketing director of the company said this to me many years ago).

The problem is, though an excellent repellent (it causes water to run off vertical surfaces), wax that is applied and buffed out is much too thin to slow water penetration for more than a few seconds on a horizontal surface.

You can easily prove this to yourself by comparing the watermark resistance of shellac with and without wax applied or, more simply, apply several drops of water to sanded scrap wood with only wax applied and buffed out. Then wipe off the drops every five or 10 seconds and see how long it takes before the grain is raised, which indicates that water has penetrated.

Bob Flexner, contributing editor

Where Can I Get SYP?

I read Christopher Schwarz's "Knockdown English Workbench" article in the November 2015 issue (#221), and I developed my love of making projects from construction lumber by reading previous articles and books by him.

But I'm from Iowa – the one thing I can't duplicate is using Southern yellow pine (SYP) for my projects. I know the long-term properties of the wood and would really like to try some.

Is there anyone who ships this species nationwide?

Jim Wikle,
Hudson, Iowa

Jim,

A search on woodfinder.com shows there are at least two lumber suppliers within a couple hours' drive of Hudson, Iowa, that carry SYP. So I'd start with a search there.

But if you'd rather have the wood shipped to you, it appears that McIlvain (mcilvain.com) and Steve Wall Lumber (walllumber.com) both offer SYP for deliv-

CONTINUED ON PAGE 10

ILLUSTRATION BY MARY JANE FAVORITE

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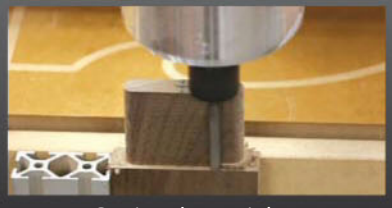

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CONTINUED FROM PAGE 8

ery (as I'm sure some other suppliers do, – these suggestions are just from a quick Internet search).

Megan Fitzpatrick, editor

18th-century Bench Update

I have a few questions about the bench built by Christopher Schwarz in his "Build an 18th-century Workbench" DVD.

How is the bench holding up after five years? In retrospect, would he make the bench wider for stability?

I am about to build my own version, complete with a quick-release Sheldon end vise, as is shown in the video. I'm also wondering if it would be better to laminate the top or go with a slab top.

Tim Pierce,
via e-mail

Tim,

The bench is still performing wonderfully – it's in my shop in the sunroom.

The thick slab top has settled down to the point where it doesn't require any seasonal maintenance to flush up the tops of the joints with the slab. This occurs when the top finally reaches equilibrium (it can take a few years). At that point, the top then becomes too thick for the seasonal humidity change to affect any part of it except the extreme ends.

So I am still a fan of the slab top, though if you can't find one, a laminated top is equally great.

On stability, I have had zero problems with the bench tipping. I always prefer the narrowest bench possible because it allows me to sleeve assembled bits of casework over the benchtop to plane them down.

The only difficulties I've experienced with the bench are my fault. I added a hinged lid to the shelf to create a little toolbox. It looks nice, but isn't very functional.

Also, there was a bit of the benchtop that was rotted. I reinforced it with epoxy, but that wasn't enough. A chunk of the rotted section popped off during holdfast cinching. Two lag screws fixed that.

Good luck with whatever bench you choose to build.

Christopher Schwarz,
contributing editor

WD-40 Passes the Acid Test

I read in the "Highly Recommended" in the November 2015 issue (#221) that Megan Fitzpatrick sometimes uses WD-40 when wiping a thin coat of oil on her tools.

I have been told by people who restore old vehicles that WD-40 contains acid, so they never use it on their projects as lubrication or protection.

If that is the case, why would she want to coat a tool with something containing acid?

Steve LaHue,
Colorado City, Colorado

Steve,

Well, all I can say is that Christopher Schwarz has been using it on and off for years on his tools, I've been using it on and off for about 10 years on mine, and my grandfather used it all the time for decades on edge tools of his that I still use. They're all still fine. (Note: My grandfather also used 3-in-1 oil from time to time.)

I don't know the full chemical makeup of WD-40 (though I've looked at the U.S. and U.K. Material Safety Data Sheets and don't see an acid mentioned on them), but experiential and received knowledge tells me the product is OK for wiping down tools after sharpening for short-term protection from rust.

That said, I greatly prefer jojoba oil; not only does it smell better (in fact, it has little smell at all), you can use it as a moisturizer. **PWM**

Megan Fitzpatrick, editor

ONLINE EXTRAS

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PHOTO BY DAN PESSELL

Highly Recommended

I have two sets of Insty-Bit countersink drill bits – one for home and one for the office. These hex-shanked quick-change bits simultaneously drill pilot holes and countersinks, and the included 1/8" hex wrench makes it a snap to adjust the straight bits to set your pilot-hole depth.

I've never had trouble with the bits slipping – and I use the heck out of the 1/8" for #8 screws. Insty-Bits are available as singles, too, and with tapered bits.

— Megan Fitzpatrick

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THE WINNER:

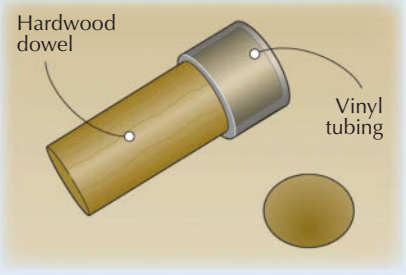
No-mar Bench Dog

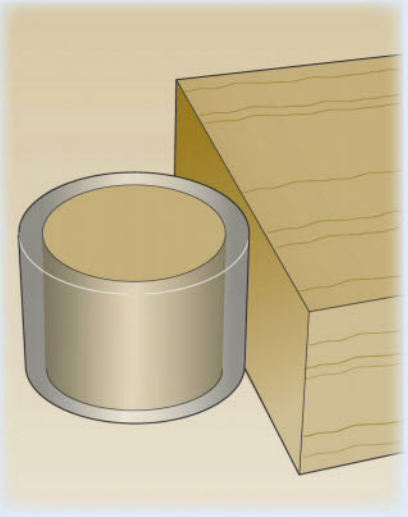
There are times when you need to hold a workpiece securely against a dog in the workbench, but don't want to risk damage to the work from a hard bench dog. Here's a simple bench dog that will be kind to your work – and you can make it in just a few minutes.

The dog holes in my bench are 3/4" in diameter, so I used a short length of 3/4"-diameter hardwood dowel with a shorter length of 3/4" inside-diameter x 1" outside-diameter vinyl tubing (available at home centers) pressed over one end of the dowel.

To facilitate putting the tubing over the dowel, sand or plane a small chamfer on the end of the dowel and soften the vinyl by immersing it in boiling water. Then don protective gloves as you stretch the tube over the dowel.

John L. Cusimano,
Lansdale, Pennsylvania





Anneal a Hardened Nail for Old-school Clenching

"Clenching" is when you drive a nail that passes through both thicknesses of wood you are fastening. The tip of the nail sticks out about 1/4" and is bent over and driven into the wood on the bottom piece. And using nails – wire nails or cut nails – to clench one board to another has been an effective and permanent joint since Roman times.

Many modern nails are, however, too hard to clench effectively – when you try to bend them over, they just make a mess of the work. But the solution is simple.

Choose nails that are longer than you would normally use for a particular job – 8*d* instead of 6*d*, for example. Then abrade their tips on a belt sander. The belt sander will sharpen and thin the tip of the nail, and heat the metal to the point where it is annealed (the fancy word for softening metal). These "clench" nails become easier to install because of the pointed tip and they bend over readily because they are annealed.

Christopher Schwarz,
Fort Mitchell, Kentucky

Inkjet Image Transfer

When creating a piece with a flat surface that calls for something extra, often a woodworker will turn to inlay, painting, carving or some other labor-intensive process. If you have (or have access to) an inkjet printer, here's an easier way to put an image onto a panel.

Peel off all the labels from one sheet of inkjet address labels and place the paper in your printer's paper tray so that the ink is deposited on the waxy side.

Pick the image you want to transfer to your panel, then use photo editing software to flip it horizontally if necessary (to make sure any text will appear correctly when the transfer is complete).

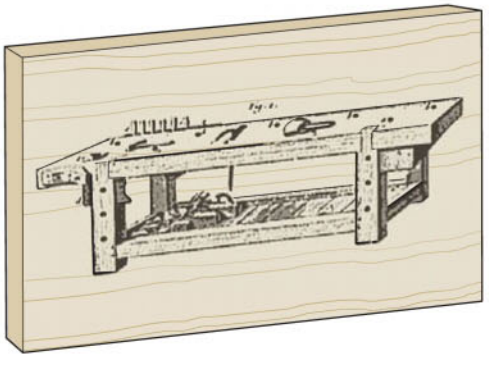
Now lay out the location of the image on your workpiece and align a piece of tape where the top of the sheet will be aligned. This will help you align the label sheet while it's covered with ink and help you avoid smudging your image during the transfer process.

Print out your image on the wax side of your label sheet. Be careful when removing it from the printer so you don't smudge the fresh ink. The image will look light, but this page is charged with ink.

Place the top edge of your image against the tape you put down on your panel, and carefully press down to affix it. Once you have it attached, slowly let the paper down onto the panel so you can transfer the ink to the surface. To transfer the ink, rub the back of the page with a credit card from top to bottom in overlapping strokes.

Remove the paper from the panel and admire your handiwork, then spray a clear finish over the top of the image to permanently fix it to the panel.

Dan Zehner,
Lafayette, Indiana



ILLUSTRATIONS BY MARY JANE FAVORITE

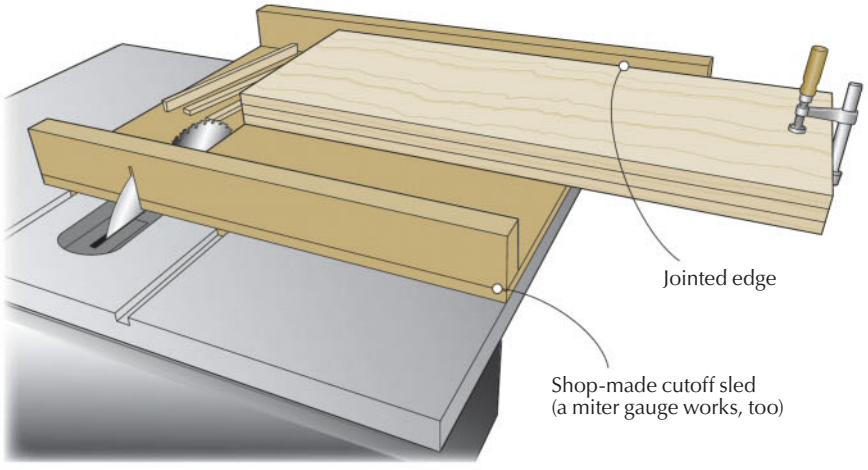
Cut Accurate Parts on a Table Saw Without a Sliding Table

My father and grandfather didn't own a sliding cut-off table for their table saws, so this is how we cut all our parts to the same size without a lot of marking, measuring or fussing.

For me this trick has always been so basic, but when I show people they freak and say, "You can't do that!"

The procedure is simplicity itself. Say you want to cut three shelves all to the same size. Stack them on top of one another with the jointed edge against your miter gauge bar or cutoff sled. Clamp the stack together at one end. Cut one end. A typical table saw will have no problem making this cut.

Then remove the clamp, flip the pile 180° and re-clamp the other end. Mark the final length and cut the entire pile in one go.



This trick saves time and – in my opinion – reduces cutting errors when compared to marking one piece, cutting it and then repeating.

Christopher Schwarz,
Fort Mitchell, Kentucky

Dampen Vibration in Your Band Saw's Wheel Covers

A few years ago, I put a layer of 1/2" MDF in the sheet metal wheel covers of my band saw to help tame a vibration issue I was encountering.

The main problem is that the rattling sounds those covers often make isn't just noisy and annoying – the wheel cover movement actually amplifies vibration throughout the machine, and that causes the performance of the tool to suffer.

To address the issue, I simply cut two pieces of MDF to fit the contours of the wheel covers (they needn't be a perfect fit or go right up to the corners), then secured each piece in place with double-sided tape.

This simple (and inexpensive) upgrade adds mass to the thin sheet metal wheel covers of any band saw to help keep those rattles to a minimum, and that reduction in vibration can result in better overall performance from your machine.

Tim Manney,
Brunswick, Maine

Drill Your Way to Easy Waste Removal for Double Tenons

I'm in the midst of making a classic rope bed completely by hand, and it requires cutting a lot of double tenons for strong joinery. Removing the waste between those tenons can be a time-consuming headache.

Here's how to do it without wasted effort: Chuck into your brace a bit that is slightly narrower than the width of the waste (if it's the same width or slightly wider you might find it difficult to get the bit started). Drill about halfway through the waste near your tenon shoulder. Flip the workpiece over and drill in from the other side until your holes meet.

At this point, you'll have severed about 90 percent of the waste near the shoulder, so it's a simple matter to split it off in chunks with a chisel. Then clean up the shoulder (where I like to employ a slight undercut).

This method makes the task a cakewalk. **PWM**

Joshua Klein,
Sedgwick, Maine

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Craftsman 10" Sliding Miter Saw

This inexpensive compact saw performs surprisingly well.

When sliding miter saws first hit the market, they could cost as much as a decent table saw. So I was shocked when I saw the price tags on the new line of miter saws by Craftsman (starting at less than $200).

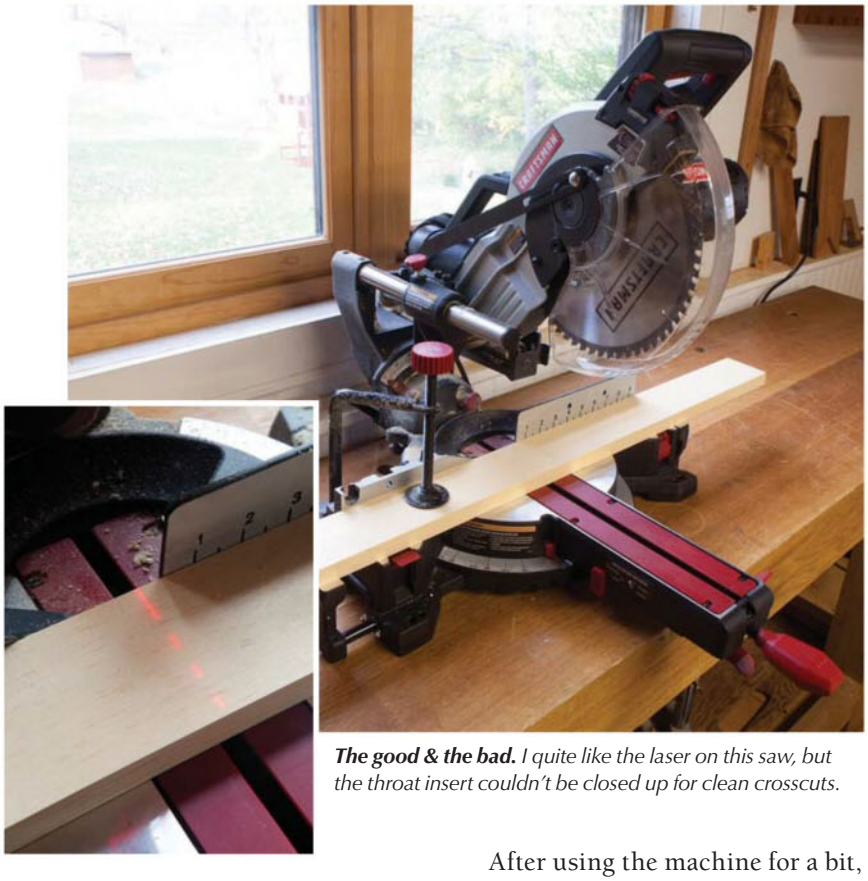
Surely they must be terrible, inaccurate and shoddily made.

So I bought one that is ideal for making furniture: The 10" compact slide miter saw (model No. 137.407530), which was $229 on that particular Saturday (watch for sales). I have a small shop, so I wanted a saw that had a small footprint but lots of cutting capacity.

The saw is remarkable for its price. It has a few compromises and bits I don't like, but overall it's affordable, accurate and well worth owning.

The 10" sliding saw can handle a 2x12 (and then some) and a 4x4. The maximum crosscut I could make on 4/4 stock was 13½". That's fantastic. The saw is no wuss – it plowed through white oak with little complaint. And it can make dead 90° crosscuts once you tune it up. Plus, it can make compound cuts (the head tips only to the right), which is nice, though it's not a feature often called for in the furniture shop.

So what are my complaints? Most are minor. The throat insert on the table is silly. It won't close up to even close to zero-clearance (7/16" is the smallest aperture allowed) so there is always going to be chipping on the underside of your piece. That will have to be replaced to do clean work.



The good & the bad. *I quite like the laser on this saw, but the throat insert couldn't be closed up for clean crosscuts.*

Setting up the saw takes a little time. The fence was out of square and the blade wasn't plumb. This is fixed with a hex key and two box wrenches and takes about 45 minutes. And the laser needed to be aligned.

The saw is a bit unbalanced because of its compact design. You won't notice this until you pull the saw carriage forward to make a big crosscut. The saw includes a little foot to keep the front from tipping, but it doesn't help if the foot is off your workbench.

The last niggle: The dust collection isn't great. But it rarely is on any miter saw.

After using the machine for a bit, I became quite attached to the saw's laser, despite the fact that I don't like gizmos. I wouldn't use the laser for a finished-length cut, but for breaking down stock, it speeds you up.

One last really nice detail: The extension tables include a flip-up stop so you can make repetitive crosscuts to the same length. Every saw should have this feature.

All in all, this is a surprising saw for $229. It cuts as well as saws costing twice as much, it's lightweight and it doesn't skimp on features you need (including a lever lock to hold your angles between detents and a depth stop for making dados in the field). Recommended.

— Christopher Schwarz

CONTINUED ON PAGE 16

Craftsman 10" Miter Saw

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CONTINUED FROM PAGE 14

EZ Pinch Stick for Checking 'Square' on Glue-ups

"Pinch rods" or "pinch sticks" are, at their most basic, two thin pieces of pointy material that are held together loosely enough at the center to move, but can be locked down. Put a point corner to corner in a carcase, lock the sticks, then check that setting against the two other corners. If they match, you're square. If they don't, you can tweak the carcase as needed.

You'll find lots of options online for making your own pinch rods, but this stainless steel and zinc version collapses to fit inside even the smallest tool chest or drawer (the tool is 7" long with the halves unscrewed).

It works not unlike the TV antennas many of us remember from our childhoods – but the metal is more robust.

It would be better, however, were it a bit heavier gauge, still. If, like me, you sometimes lay a carcase on its side to check for square, the tool can bow a bit when extended if you don't support it at the center. That said, fully extended the EZ Pinch Stick is 92" – that's a lot larger than most furniture work, so you can overcome the bowing by extending the wider-diameter tubes and leaving the thinner ones collapsed.

It would also be great if the points were a bit pointier – an easy fix at the grinder – so as to fully fit inside acute corners. Still, it's a clever, space-saving idea; my only reservations are easy to address.

— Megan Fitzpatrick

EZ Pinch Sticks

EZ Woodshop ▪ ezwoodshop.com

Street price ▪ from $34.95

▪ BLOG *Make your own pinch rods.*

Price correct at time of publication.

Bosch Barrel-grip Battery-powered Jigsaw

Because of its lower profile, I prefer a barrel-grip jigsaw to a top-handle. I feel as if having my hand closer to the work gives me better control, not only because the tool feels less tippy, but because I find it slightly easier to guide.

And I quite like this new 12-volt, lithium-ion powered one from Bosch (JS120BN) – it is lightweight (3.3 pounds) with six speed settings (and a no-load speed of 1,500 to 2,800 strokes per minute), a 3/4" stroke capable of cutting up to 2 3/4"-thick material, three orbital settings and an LED light (that can be turned off). The aluminum footplate adjusts with an on-board Allen wrench for bevel cuts up to 45°, and it locks down tight.

I'm also enamored of the small grip diameter (Bosch says it's the smallest on the market), which is comfortable both in my hands and in the larger hands of some male friends. Plus, this tool runs smooth – the vibration is minimal, and a brake stops the blade almost immediately when you turn off the switch – a little safety feature that's nice. I also appreciate the one-hand toolless blade-change mechanism; you eject the blade (T-shank only) without touching it, and can pop another in its place. (This might not sound like a big deal, but I've grabbed a lot of hot blades.)

One thing I don't like is that the speed setting is a dial at the back of the body; you can't change it in use.

But how does it perform? I ran it on and off for about 45 minutes (on one charge) through various wood species and thicknesses. It handled everything with aplomb, except for a piece of 6/4 oak – it still cut, but slowly.

I like the JS120BN enough to buy one for use at home (it helps that I already own the battery and charger). **PWM**

— MF

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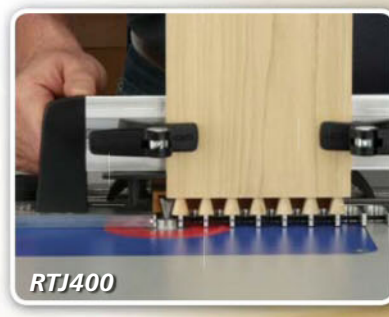

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Look Beneath the Surface

Learn the hidden order that speaks a common craft language.

Jim Sannerud is a gifted artisan who turns wooden bowls that are inspired by the rich tradition of Scandinavian woodcraft.

Recently, I was admiring his work when the conversation shifted to clay potters who turn their work on a wheel. Jim looked up from the bowl he was working on and made a simple yet profound observation. Potters and turners share a common language and the two crafts have always shared ideas and inspiration.

Now this language Jim spoke about is not some secret jargon known only to bowl turners. We often think of language strictly in terms of words. But languages that express ideas can go far beyond the limits of words.

In Jim's world, the language is primarily about describing curves. In truth, our spoken language has a very limited range of words that can describe curves: concave, convex, fast, slow etc. Yet the vast possibilities of curves and combinations of arcs are infinite. Words are inadequate.

Wooden language. *This simple yet elegant wooden bowl captivates both hand and eye. This piece, "Orange Bowl," is by Jim Sannerud.*

Cross-pollination. *Potters share a kinship with turners through their common pursuit of that elusive curve that sings.*

To the potter or turner, this shared language is found in the work itself and is spoken primarily through sight and touch. A group of turners can pass a bowl from one hand to the next and share insights that an outsider would never guess.

A modern turner in Minnesota can gather ideas from a medieval wooden bowl and in a true sense the makers, although separated by centuries, can bridge time, place and culture. The physical objects themselves contain ideas, clearly passing the knowledge from one maker to the next and one generation to the next.

Turners who work at this level are members of a small, exclusive club in the woodworking world with some stiff dues for entry. This language they share is acquired after turning hundreds of bowls. Gradually, their hands and eyes are able to look beneath the decorations on the surface and see the form itself.

A novice might look at a row of similar vase shapes on a shelf and hardly note any differences, while a practiced eye can pick out the one example that sings most clearly above the rest.

Change Your Default

I've met many talented woodworkers who have acquired this designer's eye by a similar path. After years of handling and building many pieces, slowly their ability to discern was heightened to another level. But where does that leave the rest of us who have neither the time nor opportunity to learn by osmosis?

My answer has some bad news and good news. The bad news is that there is no magic sauce (or formula) that can give you that designer's eye and judgment.

Design is always filled with sweat, challenges and failures. That's also precisely why design has so much appeal.

CONTINUED ON PAGE 20

LEAD PHOTO BY TIB SHAW; POT PHOTO & DRAWINGS BY THE AUTHOR

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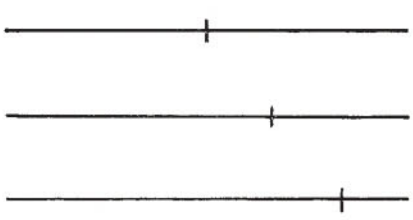
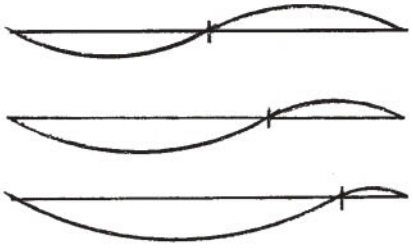


What lies beneath. *These three simple proportional patterns – symmetry, asymmetry, and punctuation – are the workhorses in design. Look for them in the structure beneath any composition.*



More to it. *Proportional patterns also apply directly to curves. To the unpracticed eye, they are just cyma curves. But now you know otherwise.*

The amount of satisfaction is in direct proportion to the challenge.

Now the good news. There are a few simple techniques you can practice to change the way your eye sees. It is possible to shift your default way of seeing and look at things from a totally different perspective.

Let's take a look at some combinations of curves and how to look below the surface to understand what you see.

Proportions & Curves

One of the most important things to note when a pair of curves flow together is how they relate to one another proportionally.

Proportion is how one part relates to another and how it relates to the whole. There are three simple types of proportion that are easy to illustrate by dividing a line as shown above.

We can divide a line into two equal parts to create symmetry, each part mirroring the other. Symmetry is often employed to carry our eye to a focal point.

We can also divide our line into major and minor parts to create asymmetry. Traditionally, designers used simple whole-number ratios such as 1:2, 2:3 and 3:5 etc. to create harmonious relationships between major and minor.

Finally, if we just divide off a small unit on one end of our line, we create punctuation. This is usually used to create borders and transitions, and is achieved by dividing a line into five or more parts and using the last part as a punctuation or border.

These simple proportions also apply to curves. In fact, the traditional way of laying out a curve was to draw a straight line, then divide it into simple proportions to locate the beginning and end as shown above.

Note how very different each of these paired curves appear, even though they all span the same distance. The next time you are looking at some curves on a design, try to imagine a straight line from where the first curve begins, through the transition point where they meet, and extending to where the second curve ends.

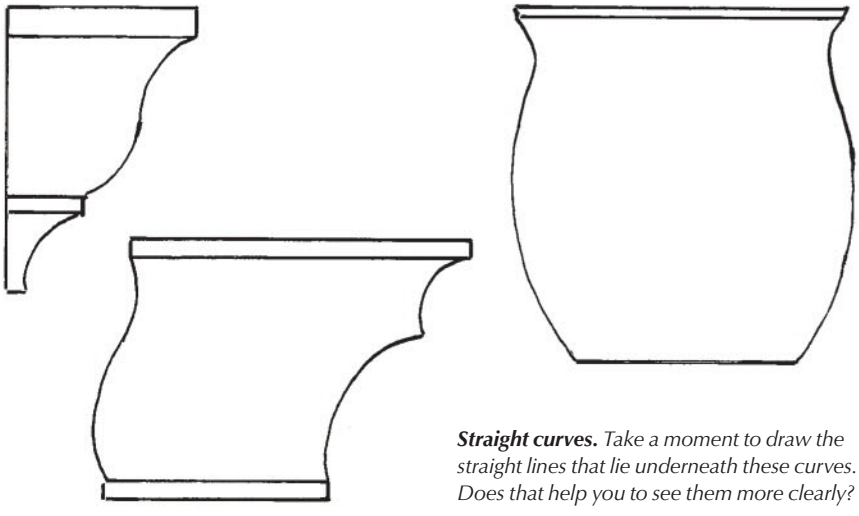
This will help you see clearly how the curves are woven together. Just for fun, draw in the straight lines in the examples below and see if it doesn't help you to see the proportions underneath the surface.

Because artisans were able to look beneath the surface, they were able to innovate and keep the tradition fresh. They could see the simple shapes within a design and compare how the parts wove together to create a pleasing form.

I like to think they could see the hidden melody in a design instead of just an assemblage of parts tied to a style or fashion. This is a powerful skill that might seem like a mystery to the modern woodworker.

If you are thinking about venturing out and trying your hand at design, a good place to begin is to learn to see this hidden structure. **PWM**

George is the author of two design DVDs (Lie-Nielsen Toolworks) and writer of the Design Matters blog.



Straight curves. *Take a moment to draw the straight lines that lie underneath these curves. Does that help you to see them more clearly?*

ONLINE EXTRAS

For links to all these online extras, go to:

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Design Matters

Design Matters dives into the basics of proportions, forms, contrast and composition to give you the skill to tackle furniture design challenges with confidence.

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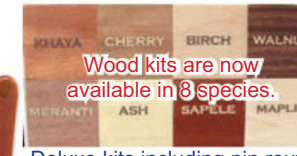

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Popular Woodworking Presents
Woodturning with Tim Yoder

— Tune in now. Shows airing each Saturday! —

Popular Woodworking Magazine has teamed up with well-known PBS star Tim Yoder to launch a new online video show, filled with expert and friendly advice that will teach you how to become a better woodturner.

In each 30-minute episode, Tim takes you through the process of making beautiful woodturning projects, from wine stoppers and duck calls to platters and bowls. Along the way, you'll learn his favorite turning tips and techniques, and he'll offer reviews of the latest lathe tools, chucks and accessories to help you determine the best products to buy.

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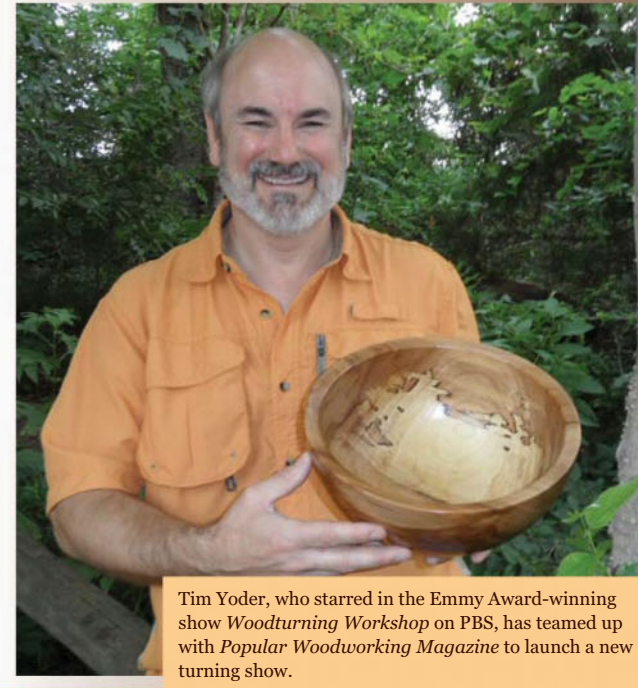
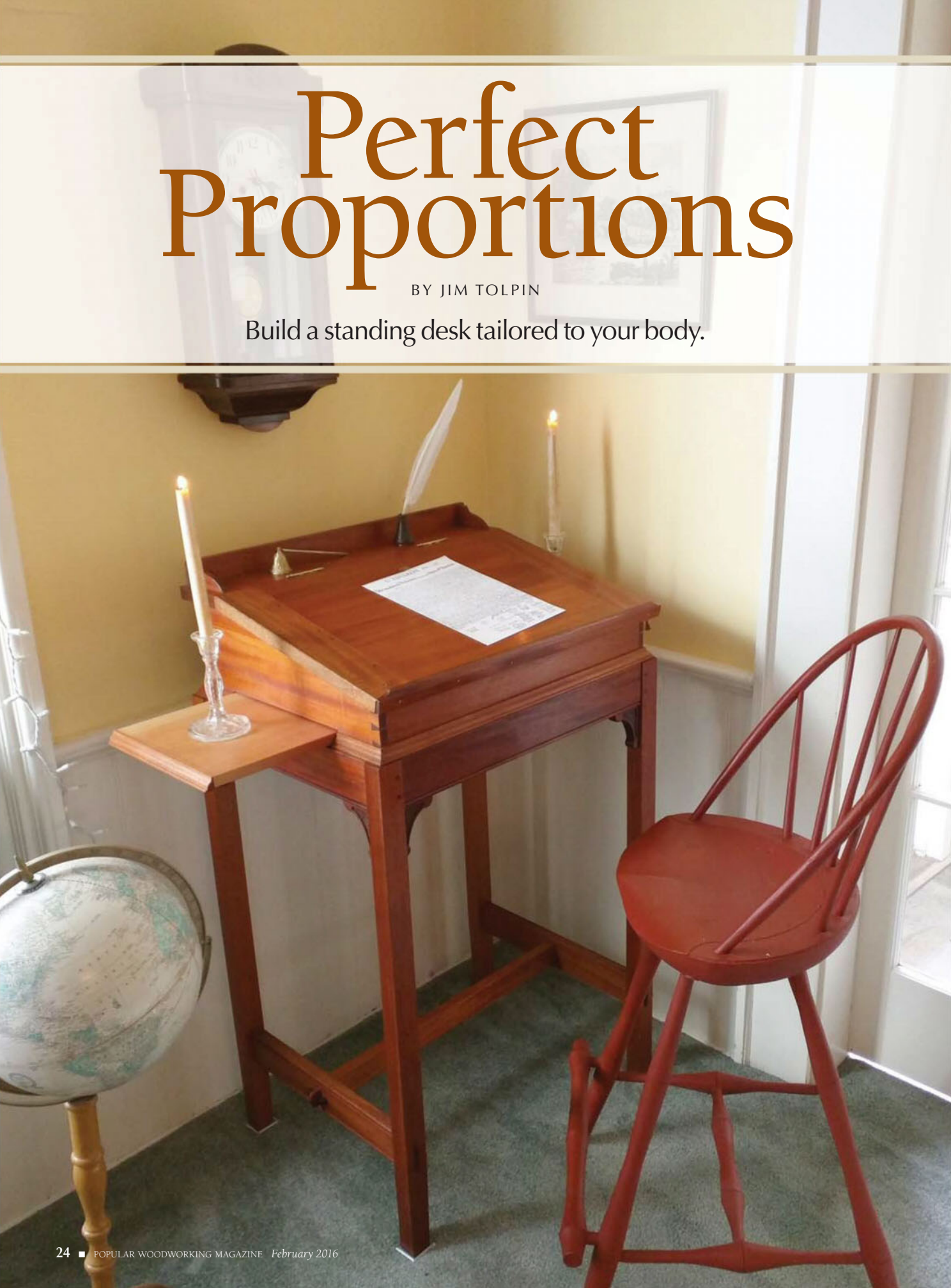


Tim Yoder, who starred in the Emmy Award-winning show *Woodturning Workshop* on PBS, has teamed up with *Popular Woodworking Magazine* to launch a new turning show.

Perfect Proportions

BY JIM TOLPIN

Build a standing desk tailored to your body.



I designed this compact stand-up desk to meet a prescription from my doctor to be less sedentary. "Sitting is the new smoking," I was admonished.

It was also to give me a challenge: to create a project start to finish almost entirely within the realm of pre-industrial technology, ramping up my education in how traditional artisans got things done.

My goals were to design the desk to human body-related harmonic ratios (a design sensibility predominant through the end of the 18th century), use joinery that negated the need for glue or fasteners for structural longevity and build the project primarily with hand-powered tools.

The desk also had to be perfectly comfortable to work at and to be, at the least, handsome.

Just right. *The distance from the elbow to the ground (about five hand spans) is a comfortable height for most people (above). I set a mock writing surface at the best height and slope for me (left), then used that measurement to mark a story stick. All the desk dimensions are based on a "module" of one hand span, or one-fifth the distance I determined.*

The Design Process

The design process began with determining a single parameter: the height of the drawing surface at its front edge.

For me (and for most people) this works out to be about elbow height – which I marked on a stick resting against a cobbled-together mock-up of the desk's top surface (see photo above). I also used the mock-up to determine a comfortable slope (mine was 1:5).

I continued to develop all the other dimensions as harmonic whole-number ratios to the floor-to-elbow height.

That comfortable working height worked out to be five hand spans from the floor – typical for adults.

I then used one of these hand spans as the common factor (or "module," as it would be called traditionally) to develop the proportions of the other dimensions.

■ For ample room for drawing, the width needs to be at least a shoulder width (which is two hand spans) plus a hand span. The width-to-height ratio therefore resolves to a 3:5 rectangle.

■ The depth of the desk should be at least a forearm from the elbow joint to the middle fingertip (which is two hand spans). So the depth-to-height ratio resolves to a 2:5 rectangle.

The width of the legs is added to the outside of the 3:5 ratio rectangle of the face and the 2:5 ratio rectangle of the side elevation. This adds more breadth to the design and therefore more stability.

■ The top of the desk resolves to a 2:3 ratio rectangle. Note that this ratio also accommodates the size and shape of most drawing papers.

While I included a cutlist for this project, the dimensions listed are from the desk I made using my hand span and elbow height as the starting point. Your desk's final dimensions can vary according to your own proportions.

Telling the Story (Stick)

Using the tool set of my eye, a set of dividers and a straightedge, I continued to develop proportionally scaled elevation drawings using these ratios, which I then erected in an isometric view. Having a true-scale drawing allowed me to get a good picture of what the piece would look like in three dimensions.

When I liked what I saw in the elevations and the isometric, I transferred the proportioned elements to a story stick using dividers. The layout revolves around the primary index marks transferred from the base/floor line and the elbow-height mark recorded on the stick from the mock-up.

I drew the module (one-fifth the distance from my elbow to the ground) and divided that in half, then into fifths. These lengths are all the dimensions I needed to lay out most of the elements of the design. I made full-size templates of the side of the box and of the curved corner bracket.

Joinery Elements

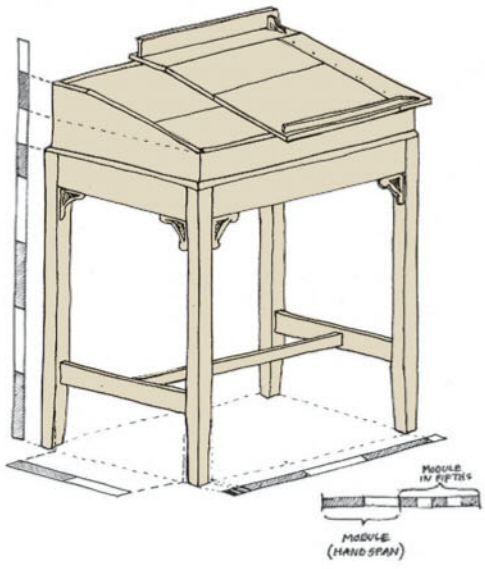
Strong, durable joinery in a tall and relatively slender structure such as this is critical. I chose drawbored mortise-and-tenon joints for the apron-to-leg connections, wedged through-tenons for the base's side rails and tusked through-tenons for the cross stretcher-to-rail connection.

Each of these joints is adjustable over time (in fact, the entire base can be knocked down for repair or transport if necessary), and the joints provide opposing (locking) connective forces. The desk box is dovetailed at its corners and features a tongue-and-groove bottom and a writing surface capped with pegged breadboard ends.

None of these joints relies on glue or fasteners to resist bearing forces. The box is secured to the base by removable screws, while the box-to-base transition is hidden behind a piece of moulding permanently attached to the base.

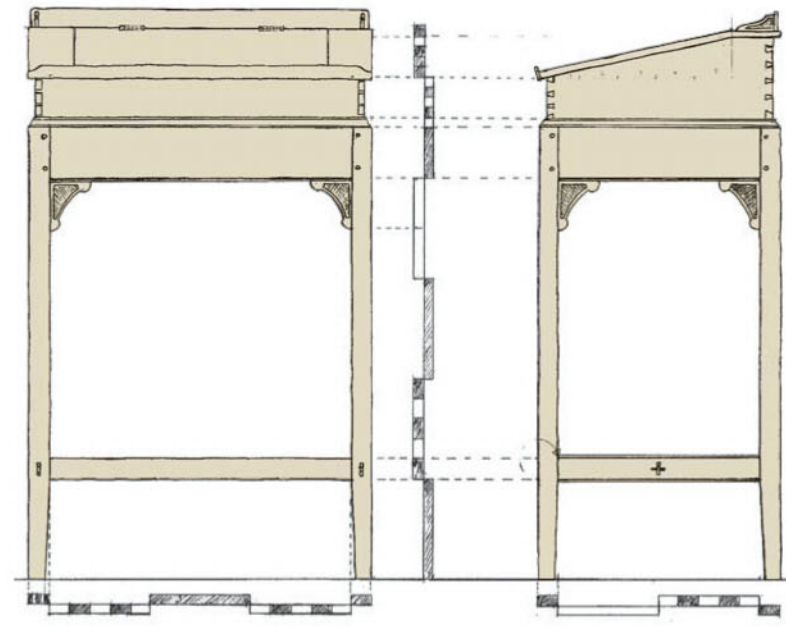
Because this project is essentially joining two independent structures – a base frame and a dovetailed box with a sloped lid – it's best to approach the construction sequence in two sections:

LEAD PHOTO BY GREG KOSSOW; ALL OTHER PHOTOS & ILLUSTRATIONS BY THE AUTHOR;
HANDSPAN ILLUSTRATION BY ANDREA LOVE



ISOMETRIC VIEW

Isometrics. *This is an isometric drawing, not a true perspective drawing. It looks a little weird, but it is much easier to draw because the module length doesn't change along any dimension as it would in a true perspective view.*



ELEVATION PROFILE

Dividing it up. *Front and side views show how multiples and divisions of the module define all the elements of the design.*

Standing Desk

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑ 4	Legs	1 5/8	1 5/8	35 7/8	Mahogany	
❑ 2	Apron sides	3/4	4	18	Mahogany	1" TBE*
❑ 2	Apron front/back	3/4	4	26	Mahogany	1" TBE*
❑ 2	Side stretchers	3/4	2 3/8	19 5/8	Mahogany	1 13/16" TBE*
❑ 1	Cross stretcher	3/4	1 5/8	27 1/4	Mahogany	2 3/8" TBE*
❑ 8	Brackets	3/4	3 3/16	4	Mahogany	3/8" stub tenon
❑ 4	Corner blocks	3/4	3	3	Mahogany	Shape as a triangle
BOX						
❑ 2	Sides	3/4	7 3/16	17 5/8	Mahogany	
❑ 1	Front	3/4	4	25 5/8	Mahogany	
❑ 1	Back	3/4	7 3/16	25 5/8	Mahogany	
❑ 1	Top	3/4	16	23 3/4	Mahogany	3/8" TBE**
❑ 2	Breadboard ends	3/4	3	16	Mahogany	
❑ 1	Fixed top	3/4	4	27 1/4	Mahogany	
❑ 1	Fence	1/2	2	34	Mahogany	
❑ 1	Ledger	5/8	1 1/2	27 1/4	Mahogany	
❑ 1	Bottom	3/8	17	25	Mahogany	†
❑ 1	Moulding	13/16	11/16	90	Mahogany	
OPTIONAL ADDITIONS						
❑ 2	Shelves	3/4	11	12	Mahogany	Radial-cut grain
❑ 2	Bottom shelf guides	3/4	3	24	Mahogany	
❑ 2	Side shelf guides	3/4	1 1/2	24	Mahogany	
❑ 1	Interior divider	1/2	1 1/8	24 5/8	Mahogany	3/8" stub TBE*

*TBE = Tenon both ends; **Tenon extends to 1 1/4" at peg locations; † = Size to fit groove

the base first, then the box. Note that this construction sequence assumes the builder will be doing primarily hand-tool joinery, fitting and smoothing.

Build the Base Frame

Select straight-grained, straight-running stock for the legs, preferably out of material thick enough to allow cutting each leg so each face exhibits a straight grain pattern. This pattern contributes to stability and prevents wild grain patterns on the legs that can make them look bent or swollen

The width of the square tapered legs is one-fifteenth the distance between the bottom of the apron and the bottom of the stretcher. Each leg will taper in its bottom fifth by one-fifth its width.

After dimensioning the leg stock square, lay out their lengths from the story stick, starting from a squared end. To avoid discrepancies, clamp all four legs together and lay out the lengths simultaneously.

Clearly mark the end cut, but make another mark to delineate an extra inch or so at the top (called the "horn") to support the wood under mortising pressure. You'll cut off this horn when the mortises are complete.

Working together. *I clamped the legs together to chop mortises for the aprons and brackets, then used a router plane to clean the bottoms of the shallow mortises for the brackets.*

Ready to go. *The top of each leg, like the two here, has mortises for aprons and brackets, and holes for the drawbore pegs.*

Look over the grain and orient the legs for best appearance, hiding the worst-looking faces at the rear of the desk. Mark the top and bottom ends with an orientation scheme – I use circles.

Lay out the location of the drawbore pegs and drill through from the front. Be sure to use backing blocks if you are power drilling, or come from both directions if using a brace and bit.

Mark from the story stick the location and lengths of the apron and stub tenons on the appropriate faces of the legs. You can clamp the four legs together for simultaneous marking to speed up the process.

Mark the width of the mortises with a marking gauge set to the width of the mortise chisel you'll be using (in this case, a chisel a little bit wider than one-third the thickness of the apron stock).

Be sure to index the shoulder of the gauge to the outside face of the legs. Make marks indicating the stub and the apron-mortise area. Make crisp marks along their lengths to register the chisel for final paring.

Begin with the mortise for the haunched apron tenons. Mark the depth of the mortises on your chisel with tape or permanent marker. Note: There will be two marks, because one mortise is shallower than the other, though they will eventually join to become equal depth. To prevent blow-out, cut the shallow mortise first.

Chop out the mortises to the mark, checking your progress with a small try square blade set to the finished depth. (With practice, I think you'll find that there is no efficiency advantage in drilling out the waste.) As you chop the waste away, you'll discover that the mortises will eventually intersect inside the legs.

Chop out the stub-tenon's mortise, working back from the apron mortise; test the depth with a combination square.

For the side stretchers, from the story stick lay out and mark the mortise location and length on each of the legs. Mark the outside face, then square around to the inside face.

Set the marking gauge to the appropriate width, then mark the width of the mortise on both front and back faces. Clearly mark the mortise area so you don't chop outside the marks. Make knife lines at the extent of the lengths to register the chisel.

Chop out the mortise going halfway through from each face.

Taper the mortise slightly to the outside. I use a simple jig (a block with a 1:9 slope clamped to the workpiece) to hold the chisel. Be sure to back up the leg firmly against a piece of scrap to prevent blow-out as the chisel emerges.

Taper the Legs

I tapered the legs slightly on the inside faces starting just below the location of the stretcher (which is one-fifth the height of the front of the desk). The taper is one-fifth the thickness of the leg.

Lay out the cut lines on the inside faces from the story stick and remove the waste with a drawknife followed by a try plane.

Cut off the horn at the top of the leg to the finished cut line. Double-check to be sure all the legs are the same length.

Make the Aprons

Size the apron stock to thickness and width and lay out the lengths from the story stick from a squared end. Clearly mark the shoulder cut line and the cut line indicating the end of the tenon. Square these lines all the way around with a knife. Saw each apron to length.

Clean up the end cuts with a block plane to see the layout lines and mark the tenon cheek cuts with the mortise gauge. Be sure to index the shoulder to the outside face of each apron. The

Proportional taper. *To taper the lower fifth of each leg, I used a drawknife to bevel down to a cut line on each side, then removed the waste. The black marks are from a grease pencil.*

SUPPLIES

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2 ■ Butt hinges, 3" x 1 5/8", polished brass
#32986, $20.99/pair

Price correct at time of publication.

tenon will be sized to the mortise (and therefore the mortise chisel) and will be centered on the board. Mark the haunch with a knife line. Also mark cut lines for the bracket's stub mortise.

Choosing the best-looking pieces for the front and sides, make orientation marks on the top edge.

Score a "V" at the shoulder cut lines, then saw down to the tenon cheek marks on each face, including the haunch at the top and bottom.

If you are going to work a decorative bead along the outside bottom edge of the aprons, this is the time to do it.

Saw out the tenon cheeks to the shoulder and haunch cuts.

Miter the ends of the tenons, being careful to keep the angle oriented properly to the face of each apron. Next, chop out the stub mortise for the haunched tenon.

Now dry-fit the aprons one at a time into the legs, checking for square and for full closure against the shoulders. Tweak as necessary. Then assemble all four and check to see if the assembly is square by using a diagonal marking stick, pinch rods or equal corner-to-corner measurements. Adjust as necessary – usually by slightly changing the angle of the leg face meeting the apron shoulders with a plane. (More significant changes might require adjusting the tenon cheeks.)

Split prevention. *Cutting the wedge slots at an angle helps prevent splitting by reducing the bending friction at the base.*

Plow it out. *I make drawbore pegs from a strip of walnut by plow-planing thin grooves until a 1/4"-square strip is released.*

Enter the octagon. *I make the square strip into a octagon by planing the facets on a shop-made jig. Count the number of strokes on each facet, and mark the square faces to keep track of the worked facets.*

When it all looks good, mark the center points of the drawbore holes on the tenon cheeks using a drill bit with a center point, then withdraw the aprons.

Using an awl, move the mark in 1/16" toward the shoulder. When the peg is driven home, it will force the shoulders tight against the face of the legs.

Drill the drawbore holes in the tenons centered on the inset mark. Be sure to back up the tenon on a scrap of wood.

Make the Stretchers

Size the stretcher stock to thickness and width, then lay out the lengths from the story stick from a squared end of each stretcher.

Clearly mark the shoulder cut line and the line indicating the end of the tenon. Note that the side stretcher's shoulders will be exactly the same distance apart as the those on the side aprons. Square these lines all the way around the stock with a knife.

Saw the two side stretchers and the cross stretcher to length and clean up the end cuts.

Use a mortise gauge to mark the cheek width of the tenons, then use a handsaw to cut the shoulder lines down to the cheek lines.

> "By too much sitting still the body becomes unhealthy, and soon the mind. This is Nature's law."
>
> —Henry Wadsworth Longfellow (1807-1882), American poet

Cut the tenon cheeks down to the shoulder lines, then saw slots in the tenons to receive the wedges.

Again refer to the story stick to lay out the location of the cross stretcher's through-mortise on each side stretcher. Mark your mortises, chop them out and work them to their final size.

Work a decorative bead detail (I added a 5/16" bead) on the top and bottom edge of the side stretchers.

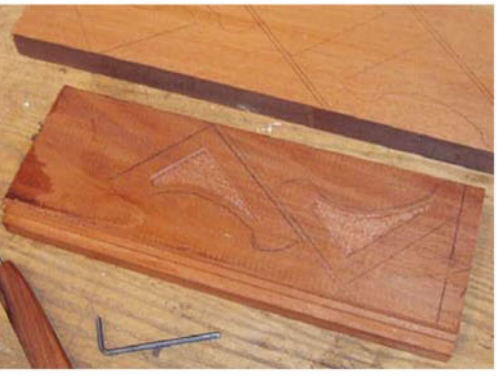
To add decorative details on the ends of the through-tenons (as shown in the opening photo), use a small block plane to bevel the side stretchers and work a beveled curve with a chisel, followed by a spokeshave on the cross stretcher.

Dry-fit the cross stretcher into its mortises on the side stretchers, adjusting as necessary for a right-angle alignment. Then mark the location of the mortise for the tusk. Note that you will overcut this inside the mark toward the shoulder about 1/16" so the tusk can do its job. Chop out the mortise. Here, drilling to remove the bulk of the waste might be helpful.

Dry-fit the side stretchers into the legs and check for alignment.

Make the drawbore pegs, 2"-long tusks and wedges. Then, make the leg-to-apron corner brackets, shaping, carving and creating stub tenons for each bracket.

If you wish, you can pre-finish all the components before final assembly (which I recommend – it's easier to get into corners before they are corners).



Casting a hex. *I laid out the corner brackets at a diagonal to avoid cross grain at narrow sections. Using chisels and spokeshaves, I shaped the rounded edges. After I carved a depression, I tapped the wood with hex wrenches to add a decorative pattern.*

Assemble the Base

Work on the side assemblies of the base first. Fix the apron to one of the legs by tapping the tenon into its mortise, then draw the shoulder into place with a tapered drift pin. Now drive in the drawbore pegs.

Make sure to put a bit of a taper on the oversized end of the pegs, wax them with a candle, then drive them home. You can clamp the apron in place first if you like, but it's generally not necessary. Glue isn't necessary, either.

Now fix the stretcher to that leg by tapping it in place, then tapping a couple of hardwood wedges into the slots. Glue one side of the wedge to help hold it in place through times of ambient moisture level changes. Repeat the process to attach the second leg. (Use hide glue if you want the ability to knock down the base.)

Finally, saw off and trim the excess material on the wedges and pegs. Install the tusk into its mortise. If it loosens when you shake the base, you have permission to add a smidgen of hide glue to hold it in place.

When both side assemblies are complete (you don't have to wait for any glue to dry) install the front and back aprons and the cross stretcher to one of the assemblies. Then fit the second side to these parts.

Check that the base is square, then glue and screw in a 3"x 3" triangular block at each corner. These will be used when you screw the top to the base.

Apron & stretcher. *I used drift pins to hold the front apron in place for final pinning. Note the cross stretcher is also installed at this time.*

Build the Angled Box

Referring to the story stick for dimensions, make a template for the box's side boards. From this template you'll be able to quickly trace the slope angle and mark the location of the dovetails and optional features such as interior dividers and slide-out shelves.

Double-check that the template and the story stick marks for the front and back pieces are the right lengths, allowing an even perimeter margin on the base (which will be filled with cyma transition moulding).

Size the boards to thickness and width, then lay out the lengths from the story stick from a squared end of each board. (For this, the story stick is easier to manipulate than the template.)

Don't cut the slope angle on the side pieces yet – it is convenient to have parallel edges for laying out.

Notice that the front is about $^{3}/_{16}$" over-width – this allows for a bevel to be worked on the edge to match the slope angle.

Saw each board to length and clean up the end cuts with a block plane, then mark the baseline for the dovetails. Square these lines all the way around the stock with a knife.

Plow a groove on the inside face of each board to accept the bottom panel.

If you choose to install a divider, refer to your template to lay out and chop the shallow mortise for the divider's stub tenon.

Using a chisel, work triangular-shaped pocket-screw holes on the upper inside face of the sides and back. The pocket screws will attach the fixed top board to the box.

Cut the Dovetails

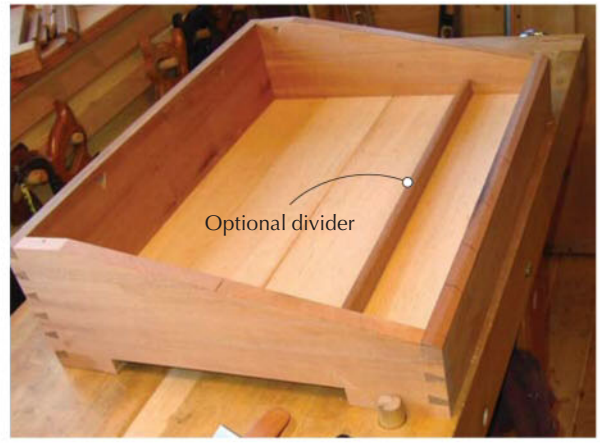
Again referring to the template, mark the location of the dovetails on the ends of the side pieces. If you think you will be making more than one of these desks, it may be more efficient to cut the tails into the template so you can simply trace them on the stock.

Square the marks across the ends of the boards, then use a bevel gauge to mark the tails down to the shoulder line.

Saw out the tails, then chop out the waste. You can drill out the bulk of the waste or use a coping saw.

Using a small ripsaw followed by a plane, work the slope angle on the sides, then trace the pins on the ends of the front and back. Also mark the slope angle on the end of the front to provide a cut line for the bevel you'll work on its

Things to come. *I used my story stick to create templates of the box's side panel and the base's corner brackets. My side panel template includes the location of the dovetails, the groove for the bottom panel, a mortise for the optional divider and the notch for an optional shelf.*



Getting close. *The notch along the side of the box is for a slide-out shelf. If you don't want shelves, don't cut the notches.*

edge. Cut out the sockets for the tails.

Dry-fit the box, checking to be sure all the shoulders fit tightly with the box squared up. Adjust the shoulders as necessary until they do.

Fit the Bottom

While the box is in the dry-fit stage, use pinch sticks inserted into the grooves to obtain the final dimensions of the bottom panel and the interior divider.

From the pinch sticks, lay out the length and width of the bottom panel (which may have to be glued up if you don't have a wide enough board). Cut the panel to size, subtracting about 1/8" from the width to accommodate potential expansion.

Disassemble the box and check to be sure the panel fits into its grooves without binding. Plane the bottom along the edge to correct as necessary.

Plane the top edge of the front board to the marked bevel angle as shown below at center.

If you plan on adding an interior divider, use the pinch sticks to lay out its length, including stub tenons, on the stock. Cut the tenons and check the fits at each end, trimming as necessary.

Assemble the Box

Pre-finish the interior surfaces of the box and the bottom of the fixed top board. A couple coats of shellac are adequate. I don't recommend oil; it would smell oily for years every time you open the lid.

On the front and back of the box, brush a light film of liquid hide glue on the cheeks of the pins. Slide on one side.

Slide in the bottom panel and the divider (which you can pre-finish with shellac) and install the second side.

Clamp the assembly together (if necessary) to press the dovetails home. Be sure the structure is square.

When the glue is dry, unclamp the box, then bevel the top edge of the front board to match the side slopes.

Next, true the slopes parallel to one another (test it with a flat board). Plane the slope and front-edge bevel to eliminate any rocking. Next, smooth plane all the pins and tails flush to the outside faces.

To finish the outside of the box, I used Bioshield Hard Oil #9, followed by three coats of amber dewaxed shellac.

Install the finished fixed top board with pocket screws driven by a stubby screwdriver. (You'll make your life a little easier if you cut and fit the but hinge mortises for the sloped lid before you install this piece.)

Erase the lines. *To match the top of the front board to the side slope, draw the line of the slope on both sides, then across the face. Bevel to the front line, draw marks across the edge, then plane away the waste until the lines disappear.*

SLIDING SHELVES

To add slide-out shelves on each side of the desk, I located the box bottom 3/4" up from the bottom edge to accommodate the vertical-grain Douglas fir in my 3/4"-thick shelf.

I notched the sides of the box to make room for the shelves, adding 1/8" of clearance along the top and sides.

The shelves slide along two bottom runners attached to the base, with a vertical side guide screwed to the opposing side of each bottom runner.

—JT

In each of the four corners, glue in small corner blocks to accept the screws from the blocks installed in the upper corners of the base.

To make the fence along the back edge of the desk, saw and shape the three pieces that will sit on the small flat (the fixed top) behind the sloped lid.

Join the two sides to the back with a stub mortise and tenon and secure it with glue on the tenon cheeks.

The fence assembly is attached to the flat with small wood pins (dowels or shop-made pegs). To locate the pins, tack in a brad at each pin point, clip it so it slightly protrudes, then press the assembly against the flat to make a mark.

Remove and deepen the marks slightly with an awl, then extract the

Hole in one. *Small pins press-fit into holes on the fixed top to secure the fence in place.*

Cheeks & shoulders. *I use a moving fillister plane to create the cheeks of the long end tenons of the lid, trimming the shoulder as necessary with a rabbet plane.*

Speed the plow. *With a breadboard end for the lid held upright in a jig, I use a plow plane to make the groove to receive the long tenon.*

brads from the fence boards. You now have the center points for drilling holes for the pins.

Make the Sloped Lid

Cut the lid and breadboard ends oversize to provide for final trimming to fit.

Lay out full-length tenons on the ends, then cut them with shoulder and rabbet planes. Then, saw the tenons (see image below).

Groove each breadboard end as shown above, then use a mortising chisel to cut the mortises. The groove helps keep the chisel aligned as you cut.

Lay out and drill the holes for the pegs that will capture the tenons.

Dry-assemble the breadboard ends to the lid panel and mark the location of the pegs on the tenons. Remove the ends and drill the peg holes in the tenons, insetting them slightly ($^1/_{32}$" is enough).

If your lid isn't made of quartersawn material, consider elongating the peg holes at the outside tenons to allow for movement.

Fit the ends to the panel for final assembly. Glue isn't really necessary as long as the pegs are tight-fitting – but go ahead and apply a light film to the interior of the grooves and mortises.

I shaped a simple cyma curve on the ends of the ledger (the strip at the front of the lid) with a chisel, then smoothed the curves with a small spokeshave.

I then worked a shallow rabbet in the attachment side of the ledger to create a bearing surface that will resist downward pressure from elbows.

I used brass escutcheon pins and a bit of hide glue for holding it in place. (Note that the pins don't bear any load; they just hold it in place so the wood can bear the load.)

Make the Moulding

I stuck the cyma moulding for the box using a moulding plane that creates the full profile. An alternative is to use a pair of hollow and rounds (or, of course, router bits).

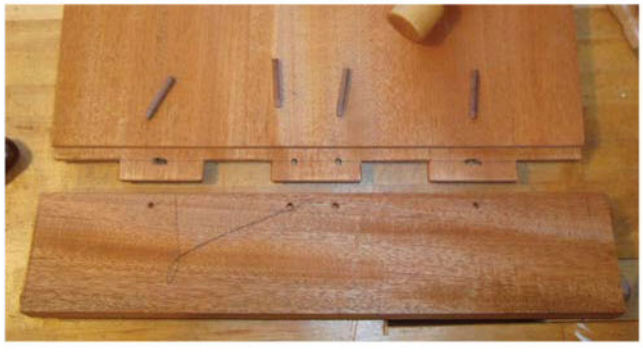
Center the box on the base to ensure an even margin, then secure it with screws up through the base's corner blocks into the box's corner blocks.

Now work your way around the perimeter, marking, mitering and fitting the ends of the cyma moulding as you go. The final piece is the tricky one because you have to get both miters to fit at once.

Overcut the length slightly and block-plane it until it fits tightly at both ends (a shooting board ensures an accurate miter angle).

Install the moulding with brads (I use tiny square nails because they hide better and tend not to split the wood).

Now sharpen your quill pen, and be a stand-up guy or gal and write to your mother (or kids). **PWM**



Movement allowed. *The end caps are held securely in place with walnut pegs. Notice that the holes toward either end are elongated to allow the panel to shrink and expand without cracking. I used round rasps and files to create the elongation.*

Jim is the author of several books, including "By Hand & Eye" and "By Hound & Eye," both co-written by George R. Walker (Lost Art Press).

Profiling. *I used a skew rabbet plane (technically a moving fillister plane because it has a fence and stop) to remove waste before using a moulding plane to cut a cyma profile.*

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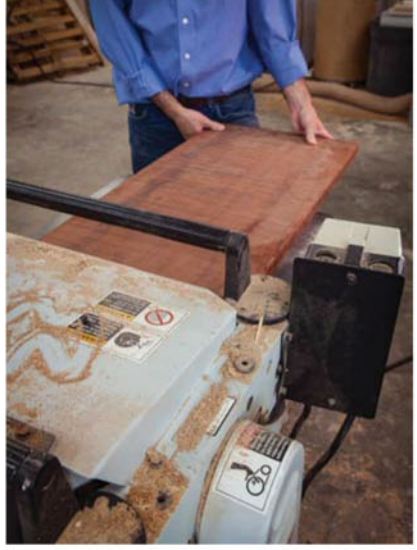
Why Portable Planers are Better

BY CHRISTOPHER SCHWARZ

While we lust for a 20" monster, most woodworkers would be just as well off (or better) with a 'suitcase planer.'

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR



Mouth of the beast. *It's easy to have a strong itch for a massive thickness planer. And if you work in a production shop that deals in wide lumber, you probably should scratch it.*

A different spin. *An induction motor (at left) can last for 50 years of heavy use and hardly break a sweat. They are bulky and take time to spin up. Universal motors have instant torque, are small and inexpensive. But they aren't as reliable.*

When I started woodworking in about 1993, I wanted two things: a table saw with a decent rip fence and the biggest thickness planer on the planet.

In my opinion, planers are the biggest labor-saving device ever invented for the workshop. You might think it's the electric jointer, but I disagree. Any half-witted woodworker can do the work of an electric jointer – e.g. flatten one face and edge of a board – with a $20 jack plane.

But if you want to then remove a 1/2" of material from 20 boards and make all the surfaces dead parallel, put your handplane down and fire up the electric planer. It can turn days of sweat into a few minutes of easy work.

For many years, I lusted for an enormous cast iron, induction-motor battleship with a 20"-wide mouth. When I got my wish, however, it was anticlimactic. The finish on the boards it planed was just OK. And I sure as heck wasn't happy with how much space the 20" monster hogged in the shop – never mind the bill for the machine or the tedium of the jackscrews when changing knives.

Had I Reached Too Far?

When I set up a new shop in 2011, I skipped the cast iron planer. Instead, I bought an inexpensive, portable, universal-motor planer that fits under a workbench. It leaves a better finish. The knives are a snap to switch out. And I've been surprised – no, shocked – by how tough the machine is for daily use.

If you are shopping for a planer, I hope to convince you to save money, space and time by purchasing a portable machine and ignore the call of the heavy-metal sirens.

What's the Difference?

At their core, both portable planers and bigger stationary models do the same job and in the same way. Feed rollers pull your wood under a spinning cutterhead. Put rough stock in on one side (note that the face of the board against the machine's bed needs to be flat); perfectly surfaced boards come out the other side.

The difference between the big and small machines is in the details. During my career, I've tested and examined hundreds of thickness planers and used them in shops all over the world. Here are my observations.

The Big Boys

The big cast iron planers are powered by induction motors. These motors last forever, are quiet, run at fairly low speeds and are difficult to stall. I have induction motors in my shop that are older than I am. The only real downside to these motors is they are fairly big.

A painful change. *Traditional jackscrews (left) take time to adjust when changing knives. Carbide inserts (right) are great until you have to change all 300 of them and clean all 300 beds on the cutterhead.*

The induction motor in a big planer usually drives the machine's cutterhead and feed rollers using a robust transmission of chains and gears. These parts are almost always metal and bulletproof, but they require regular lubrication. (If you own a big planer you should know by heart where its grease ports are.)

The planer's cutterhead usually has three knives (or a series of little carbide teeth) that cut the wood. The knives are clamped into the cutterhead using screws or friction. If the cutterhead has carbide knives, these can be changed (laboriously) with a screwdriver. If the cutterhead has three straight knives, they can be changed (super-laboriously) with a variety of tools and a day of downtime.

Adjusting the knives on a basic planer is its own circle of hell. So much so that you end up buying devices with magnets and dial indicators that promise to make it a snap. Truth is, nothing helps more than trial, error and experience to get the knives in position. (Yes, you can buy aftermarket cutterheads with quick-change knives. Why aren't these standard on every machine?)

The induction motor also drives the planer's feed rollers, which can be rubber or metal. These pull the wood through the machine. In addition to the feed rollers, many of these big stationary machines have rollers in the bed below that are called (surprise) bed rollers. These rollers help move heavy stock through the machine.

What you also get are a bunch of adjustable bits. You can alter the height of the infeed and outfeed rollers, plus the bed rollers. And you can even adjust the parallelism of the cutterhead to the bed of the planer.

While these adjustments seem a great idea when you buy the machine, you will quickly tire of them when the machine's settings slip after vibration and use. Some machines need more love than others, but the bottom line is that if something can go out of adjustment, it eventually will.

After years of pushing thousands of board feet through these machines, I find them to require more maintenance than justifies their capacity in my small shop. But in order to understand why big planers are difficult, you need only go to the home center and pick up a portable model.

Fiddly bits. *The chains, gears and other metal parts make the machine more durable, but also more likely to go out of adjustment in the future.*

Portable Planers

Sometimes called a "suitcase planer," this small machine was invented by Ryobi in 1985 and single-handedly changed the market. The inexpensive AP10 10"-capacity machine is still at work in shops 30 years later, and it spawned hundreds of imitators. And many of the imitators became so fantastic that I lost my lust for a cast iron machine.

What's to love about this machine that looks like an oversized toaster oven? Plenty.

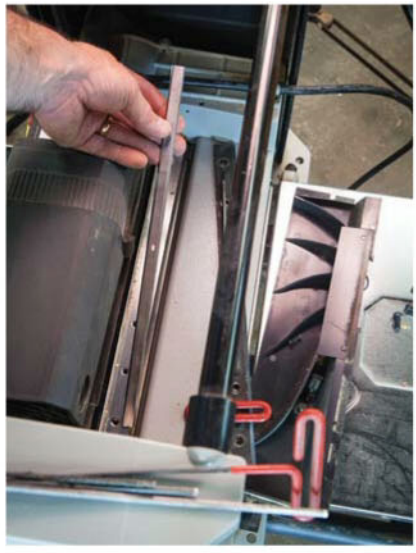
The greatest weakness of the machine – the high-speed universal motor – is also one of its strengths. Universal motors – the noisy beasts in your router, sander and portable table saw – run fast, are small and are inexpensive to make to a high standard of quality.

The downside is they can be stalled more easily than an equivalent induction motor and aren't as durable. After years of use, you might have to replace the motor's brushes to restore it to new. (Some manufacturers make it almost impossible to replace the brushes – what's that about?)

The small motor size helps make the machine lightweight. The high speed allows the motor to easily spin the cutterhead really fast – the 20,000-rpm motor will be geared down to spin the cutterhead at 8,500-10,000 rpm or so. Compare that to an induction-motor planer that spins a typical cutterhead to only 5,000 rpm.

Why do we care about rpm? In general, faster cutterheads leave a better finish. With a fast cutterhead, each knife takes a smaller bite, reducing the chance of tear-out.

Look for it. *A port such as this indicates the brushes of the motor will be easy to replace. Pick up the phone right now and order replacement brushes for your planer. They are good to have on hand.*



Presto change-o. *Quick-change knife systems get you back to work in less than 30 minutes. Once you try one, you'll not willingly go back.*

There's more to say about the cutterhead. Even if portable machines didn't leave a better finish, I'd still prefer them because – on the whole – the knives are easier to change.

The vast majority of portable planers have a "quick-change" system of swapping out the knives. You usually loosen some screws, remove a plate, then pull the old knives. Then you drop the new knives on some pins on the cutterhead and screw things down. I can change the knives on a typical portable planer in 30 minutes, and they will be set perfectly at that point.

On a typical old-school planer, it can take a couple hours to swap the knives – and then you have to get them all cutting in the same perfect arc. That takes more time and luck. But, you might be saying, what about the spiral carbide cutterheads on big planers? Aren't those easy to change? Yes, they are simple, but they are even more time-consuming. A 20" planer can take an entire day. Been there.

The advantage of quick-change knives is that you will change them as soon as they get dull and your work will benefit. With the old-school planers, most people put off the maintenance until it absolutely has to be done. By then, a lot of wood has been mangled.

After the cutterhead, the next advantage of the portable machines is their

NOT-SO-STUPID PORTABLE PLANER TRICKS

While portable planers need little maintenance or setup, here are a few tips on getting the most from your portable planer:

1. To make the most of a less-gutsy motor, skew the stock slightly as you put it into the machine. The skew reduces the effective cutting angle and lessens the load on the machine.

2. Lubricate the planer's bed with a dry lube to make the most of the motor. In my experience, the spray-on lubes are better than paraffin. No, the dry lubes won't interfere with finishing.

3. Don't throw away used portable planer knives. That is awesome steel. You can use them as-is (even dull) as scrapers. Or anneal them and you can make them into chisels or anything else. Heck, you can even resharpen them.

4. Not necessarily recommended but too cool: For planing heavy and long stock, feed the planer onto the stock and allow the machine to pull itself along. Yes, I've done this. Beer was not involved. I got this idea from timber framers.

5. To reduce snipe (yes, all planers snipe), feed the boards one after the other without pause – tricking the machine into thinking it is planing one continuous board. On the last board, lift it slightly as it comes out to reduce snipe.

6. Clean the rollers. The rubberized rollers of portable planers need cleaning or they won't grip. Use a non-toxic pitch remover such as CMT's Formula 2050, especially after planing pitchy pine. If you are someone who goes "all out" in maintenance, dust the rubber rollers with talcum powder to keep the rubber supple (a trick from my automobile restoration days).

7. While you should definitely ignore the thickness gauge on the planer as a way to reach your final thickness, don't ignore the position of the hand wheel that moves the cutterhead up and down. Many manufacturers time the handle on the wheel so that a certain position – say 12 o'clock – represents one of the common finished thicknesses. For example, my portable planer travels in $^{1}/_{32}$" increments with every turn of the hand wheel. And all the finished thicknesses end with it at 12 o'clock. When my hand wheel is not at 12 o'clock, then I know for sure that I'm not at a perfect .500", .750" or .875". Experiment with your planer and see if this works. — CS

You need an extension cord. *Yes, a planer can pull itself along like this for long and heavy stock. Do this outdoors and with a long extension cord. It's like walking a robotic dog.*

You don't need it. *Little niceties such as this stock-removal gauge are almost worthless. Don't buy a machine based on these little gizmos. Go for simple and reliable.*

size. Space is at a premium in my shop, so the portable planer was welcome into my 15' x 25' workspace. In fact, I saved so much space by getting rid of my cast iron planer that I was able to make space for a second workbench and midi lathe.

Next big advantage: Cost. A good portable planer sets you back hundreds of dollars – not thousands. That leaves more money for wood, hardware and other tools.

And let's hear it for the gizmos on portable planers! Or maybe not. Many of these machines are festooned with stupid plastic depth stops, variable speeds and other little screwy doodads. Ignore them when choosing a machine. Get the one with the best reputation and the biggest capacity.

Disadvantages to Little Guys

One of the disadvantages to these small planers is they can handle boards up to only 13" wide. For most home woodworkers that is plenty of capacity. If you need 24"-wide capacity every day in the shop you are quite unusual. Sure, I wish my 13" planer would take 15"-wide boards on occasion, but I get by.

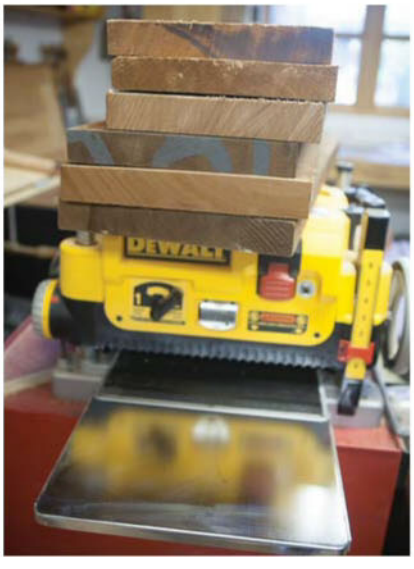
The other disadvantage is the motor can stall if you deal with wood that has been cut by a drunken sawyer. This is a real concern. In the 1990s I could only afford wood from a sawyer who charged $1 a board foot, regardless of species. He cut it and dried it himself.

The glitch was that his boards tended to taper in thickness from one end of the board to the other. So it was easy to overload my portable planer's motor. Once I switched sawyers (and started buying better stock), I never had the problem again.

I also have to mention noise. Because of the universal motor, portable planers make a racket. I've measured planers that make more than 100 dB, and they get louder when they are under load. Planers with induction motors run much quieter, though you still need to wear hearing protection. The difference, for me, is how much hearing protection. With big planers, I can wear earbuds. With my portable, I wear earbuds plus earmuffs.

You also aren't going to find as many accessories for your portable machine. If you want to ever upgrade to an indexed carbide cutterhead, you might be out of luck with a portable (though these cutterheads are available for some portables, such as the DeWalt 735).

The final disadvantage of portable planers is that – unlike a cast iron planer – you are unlikely to hand the machine down to your grandchildren. These small machines are durable enough for your lifetime, but they are unlikely to survive as long as a cast iron planer. There are simply too many plastic parts inside a portable planer.



Poison for portables. *Stock that varies in thickness can stall a universal motor or cause it to trip a breaker. If your stock is like this, take passes to reduce the thick parts down before getting aggressive.*

> "The latter part of a wise person's life is occupied with curing the follies, prejudices and false opinions they contracted earlier."
>
> —*Jonathan Swift (1667-1745), Irish author & satirist*

How to Decide

If you run a busy professional shop, you probably haven't even made it to this point in the article. You think you need heavy metal alone to get the job done. But before you put down this magazine, consider this:

I've been in professional shops where the owner used portable and stationary planers in tandem. The big machines beavered the work to a close finished size. Then a portable planer set permanently at one thickness would take all the stock for making face frames to a perfect .750".

This setup left a great finish on the stock and allowed the face-frame material to work perfectly with the other tooling in the shop without any adjustments.

The funny thing was that one of the shop owners had mounted his portable planer (a Ryobi AP10) to the wall for this – so it wasn't portable anymore.

Anyway, if you're not in a production shop or you just build custom one-offs, chances are you can be efficient and happy with a portable machine. Bigger is not always better – or smoother. **PWM**

Christopher is a furniture maker and the publisher at Lost Art Press.

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Shop-made Bandings

BY MARIO RODRIGUEZ

Learn to make your own and you'll never have to compromise your design.

Bandings and stringing are a dramatic and exciting way to dress up your period furniture. I see them as a way to highlight some aspect of a piece by directing the viewer's eye to a particular area. Bandings give emphasis to the lines of a piece, similar to pinstriping on a car.

The use of bandings also demonstrates a skill closely tied to the successful design of a piece. In other words, a too-thick, busy or colorful banding can ruin a piece. That's why I never buy bandings; I make them. That way, I get to decide on the pattern, colors, types of wood and size. I never have to settle or compromise, or modify my design to suit what's commercially available.

Here are a few tenets to which I always adhere:

■ Eye-catching patterns: Design or copy a pattern that causes the viewer to pause, and perhaps ponder how it was made. An attractive pattern will be part puzzle and part tease, with a touch of pizzazz.

■ Clarity and high contrast: The most successful bandings are constructed in a manner that amplifies the contrast between different pieces and colors. Each piece clearly stands out from the surrounding pieces/segments. That means the grain direction should be oriented to stand out in contrast to the surrounding wood.

For example, to maintain the sharpest, truest color and the greatest contrast, I never show end grain. While cutting to display only long grain can present problems in how to safely, uniformly and efficiently produce the components for an attractive banding pattern, the result is always worth the extra effort.

■ High-quality material: I always set aside any scrap with an interesting or unusual grain pattern or color. And I always select the cleanest, straightest board stock I can find. Clean, straight stock behaves well and thus presents fewer problems and yields the most banding for the effort. For example, pin knots, cracks or abrupt changes

PHOTOS BY THE AUTHOR

Helping "hand." *This Baltic birch plywood push stick not only has a hook to push the back edge of a thin piece of stock through the blade, the projection holds thin, lightweight workpieces flat to the table of the saw.*

Measured cuts. *A standoff block provides a safe way to cut very small pieces (when used in conjunction with a crosscut fence).*

in color could create a distraction that would compromise your design.

■ Materials of uniform thickness: Stock of the same thicknesses and dimensions will produce the most handsome banding. Carefully dimensioned stock is easier to glue up and clamp, and will produce banding without visible voids and gaps. Using a micrometer (calipers) is a big help in this task.

Basic Equipment & Tools

No matter how simple or complex your bandings, there are some basic tools, equipment and jigs necessary to produce great work. None are expensive, or difficult to obtain or make.

A high-quality, thin-kerf table saw blade is essential. At my school (Philadelphia Furniture Workshop), we use a 50-tooth, 10° hook, 10" Freud Industrial blade. It easily and smoothly handles a range of cuts with excellent results. The narrow kerf also cuts down on waste.

A solid and accurate table saw crosscut guide, fitted with a replaceable wooden fence, will ensure accuracy and safety. You'll also need a zero-clearance table saw insert to prevent gaps between the blade and the worksurface; a gap can trap material, jam the blade and interrupt your work.

Ripping thin and narrow pieces requires careful cutting technique(s), so keeping your fingers well away from the spinning blade is paramount for safety. A push stick designed for the task (shown above) will manage even the thinnest pieces of material safely.

A stand-off block gives me the ability to produce precise and uniform pieces for gluing up bandings, and prevents pieces from becoming trapped or flying back at me.

You'll also want a digital or dial micrometer to accurately measure the thickness of your material.

Federal Embellishment

In the last few years, Federal-period furniture has become more popular than ever (outside of the Federal period itself, of course). Woodworkers all over the country are building sideboards, Pembroke tables and card tables that feature stringing, inlay and gorgeous bandings.

Of the many (furniture) makers working during this period (circa 1790-1830), John and Thomas Seymour stand out and their masterful pieces fetch astronomical prices at auctions. Besides the impeccable construction, Seymour pieces are distinguished by their striking bandings, two of which are unique and almost exclusive to their work. The best-known and most widely used of these is the lunette banding. The other is the distinctive and challenging arrow banding.

On a dressing mirror build I designed (and what I teach at the Philadelphia Furniture Workshop), both the arrow and lunette bandings are major features, along with a simple vertically oriented band that separates the case from the base.

3-piece Banding

This is the easiest to make of the three banding designs used on the dressing mirror. It's a three-part pattern made

Dressing mirror. *This piece features three banding designs: a simple three-piece banding that separates the case from the base; a lunette banding around the case top and an arrow banding around the mirror.*

Glue up. *The short chips of mahogany get sandwiched in between thin strips of maple.*

up of a core strip flanked by lighter contrasting strips. In this case I used 3/8"-thick mahogany for the core layer and sandwiched it between 1/16"-thick layers of maple.

Notice in the photo above that the grain of the core is vertically oriented and not running along the length of the banding. That means there are no miters to cut as it turns the corners on a case.

The safest way to cut these cross-grain pieces is to use a stand-off block with a zero-clearance table saw insert. This simple shop-made device (see the photo at top center on the previous page) provides essential clearance for the small chips as they separate from the larger workpiece; otherwise they could become trapped between the blade and fence, posing a hazard.

After cutting as many pieces as you think you'll need, cut 20 percent more. Discard chips with any flaws, tear-out or abrupt changes in color. Apply glue to the surface of a maple strip and place the mahogany chips end to end atop the maple strip, keeping the chips tight together and square to the maple below.

"Patience is the best of all instructors."

—Publilius Syrus (85-43 B.C.), Latin writer

Then apply glue to the second maple strip and set it on top of the mahogany chips. Align the layers carefully and tape the lamination together with masking tape to prevent any sliding. Then clamp the brick and allow it to dry overnight.

I usually clamp directly to the benchtop with a caul on top of the glue-up, after covering both the caul and benchtop with non-stick tape. The benchtop ensures flatness (assuming your bench is flat, of course) and the caul provides even pressure along the length of the banding brick.

Plugged. *Using a good-quality plug cutter and a tight-grained species such as the maple shown here, cut more plugs than you think you'll need.*

Lunette Banding

A strip of shaded half-rounds set close together is called "lunette" banding. Each semi-circle displays shading on one side only. Inside the larger half-circle is a smaller one, shaded on the opposite side. The trompe l'oeil effect creates the illusion of depth and relief.

I've examined many examples of this distinctive pattern and pondered how it might have been fabricated in the 18th and 19th centuries. I imagine period woodworkers cut a series of half-moon shapes using curved gouges, then sand shaded the individual pieces before joining them together. This always sounded both tedious and ominous to me, with a dubious outcome at best.

Freddy Roman, a Massachusetts-based furniture maker, came up with this elegant method for producing lunette banding. His method involves embedding shaded plugs into a strip, then ripping the strip in two and capping each half with contrasting bands to make up the brick. Here's how to do it.

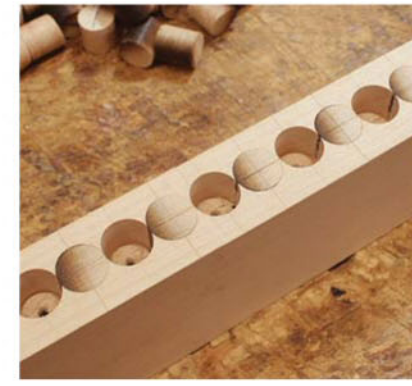
Using high-quality 3/8" and 1/2" plug cutters (I like the ones sold by Tools for Working Wood), I produce a quantity of each size plug, punching out about 25 percent more than I need so I can pick the best ones. I chose maple for the plugs here because the tight, close grain will show well and produce even, gradual shading.

After cutting the plugs, sand shade them on one half. For the best results,

Feel the heat. *It will likely take a little trial and error to get the sand temperature right. Aim for about 1/4" of sand in the bottom of the pan, and don't stir. It should be hot at the bottom and cooler toward the top.*

Grid. *Aim for perfection by marking out a grid on the lunette strip blank (the "ground").*

Plug. *Glue the shaded 1/2" plugs into the holes, making sure the shaded sides all face the same direction.*



Drill & plug again. *Now drill holes on center in between the plugs, and plug those.*

I recommend using a small hot plate, a cast iron skillet and a cup of fine-grained sand. Turn the thermostat to high and allow the sand to heat up (it should feel hot to your hand about 6" above the surface), then select your best plugs and set them into the heated sand. I prefer to shade them a little dark to ensure that once inlaid and sanded, the plugs will still show nicely. It might take some trial and error to determine how long to leave your plugs in the sand.

After sand shading the plugs, I arrange them in rows by size (1/2" and 3/8"), from dark to light, left to right. That way, any differences in shading will be gradual along the length of the banding strip and less noticeable.

Begin the next part of the process with a clean, straight-grained block of maple, measuring 1" x 1 1/2". Onto this "ground," carefully mark out a 1/2" grid.

Drilling and plugging the strip is done in two stages. In the first, drill 1/2"-diameter holes at 1" intervals to a depth of 3/4". Glue the 1/2" plugs into these holes, with the shaded sides facing in the same direction, and allow the glue to thoroughly dry before proceeding. This is critical. Any attempt to rush the process will result in failure.

In the second stage, drill 1/2"-diameter holes – again at 1" intervals – in between the already plugged holes. Now fill the new holes with shaded plugs (again making sure the shaded halves are in the same orientation).

When all the 1/2" plugs are glued and thoroughly dry, trim them flush with the maple ground to create a clean, flat surface. Mark the centers of all the 1/2" plugs clearly. Now carefully drill 3/8"-diameter holes on those marks.

Plugged plugs. *Drill 3/8"-diameter holes centered in the 1/2" plugs, then glue the 3/8" plugs in place. Note the direction of the shaded edges of the smaller plugs.*

Bricked. *Here's the completed glue-up of ground, sand-shaded plugs and walnut and maple laminations, ready to be sliced into 1/16"-thick strips for use.*

Into these holes, you can now safely glue all the 3/8"-diameter shaded plugs (there's no need to do it in stages), with the shaded edges facing the opposite direction as on the 1/2" plugs. When these are dry, trim the entire strip flush.

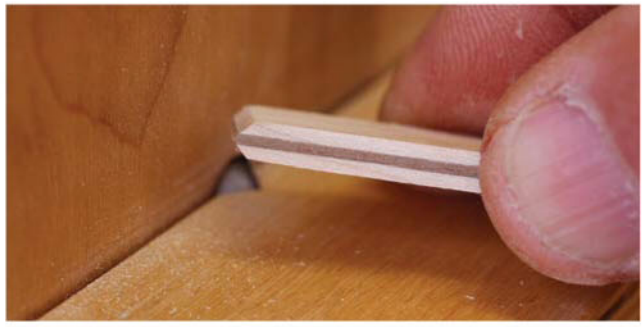
Now glue up a two-part lamination of 1/32"-thick walnut and 3/32"-thick maple strips, and allow it to dry.

Rip the plugged strip in half at the band saw (because of the thin blade-kerf, you'll get two usable pieces, each about 7/16" wide). Plane or sand the surface flat, then glue the walnut and maple lamination to the freshly cut side. Because this banding will be set into a dark mahogany ground, I placed the maple side out for the best contrast against the mahogany. Secure the lamination between a benchtop and a caul, then clamp it to set up.

After the glue is dry, rip the plugged strip to about 3/8" wide, then glue on the second walnut and maple lamination.

Arrow Banding

This is a handsome banding pattern that although rare, was not exclusive



Test cuts. *Using a longer piece of the center shaft lamination (because the contrast makes it easier to see that the point is centered), adjust the jig until the bit is cutting a perfect point.*

Hold down. *The arrowhead pieces are tiny and the router bit is sharp. Protect your fingers – and hold the workpieces tight to the jig's table – with a hold-down that helps push the workpiece across the bit.*

to Seymour furniture. Similar to the lunette pattern, the arrow banding requires a number of carefully executed steps to achieve the desired and elusive result. The completed pattern should be crisp and tight.

Frank Vucolo (a student at my school and an accomplished maker in his own right) and I struggled with various methods to accomplish this tiny joint. Frank beat me to an ingenious solution and came up with a simple router setup that got the job done. Once he brought it to the school's shop, we refined the jig with a micro-adjuster, which permits fine-tuning of the shelf that holds the workpiece to ensure perfect centering of the cuts and deliver impeccable results.

The jig is shop-made from plywood scrap, fitted with an off-the-shelf 1/4"-20 threaded screw. The bit is a 45° sign maker's router bit from Infinity (#15-127 1101). The jig supports a trim router and has a table that is adjustable relative to the router bit. (It can also pivot slightly.) It's the adjusted position of the same bit that allows the creation of both the pointed and recessed cuts (see "Router Jig" below).

The arrow design is made of five layers of veneer with three separate parts to the design: the arrowhead (or tail feather), the center shaft and two outer layers. The hardest part is milling the delicate cuts that engage the center shaft and arrowhead sections, which must be exactly the same thickness.

The first task is to laminate three layers of veneer to form the center shaft. The darker arrow shaft should gauge at 1/16" thickness, with the lighter surrounding layers at 1/32". Glue up the three layers to make up the center shaft.

The arrowhead material should

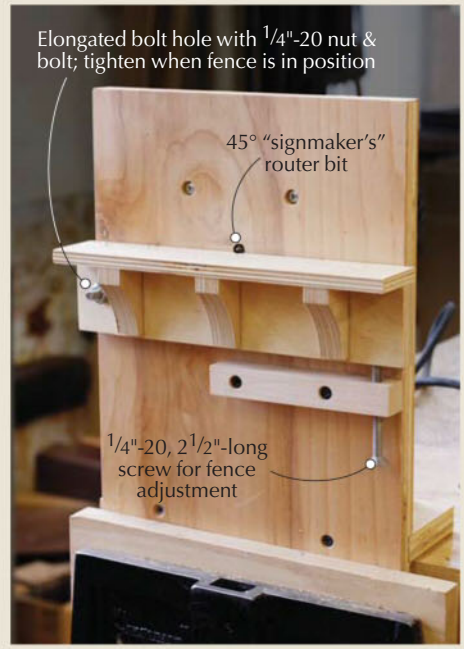
ROUTER JIG

This simple-to-build jig (designed by Frank Vucolo) holds a trim router for making perfect V-cuts for the arrow banding.

The exact dimensions aren't critical – what makes it work is the micro-adjustable table that holds the workpiece so you can center the trim router bit on the work.

This one is made from 3/4"-thick plywood with a 1/2" plywood table; the overall dimensions are 9" x 16".

— MR


Elongated bolt hole with 1/4"-20 nut & bolt; tighten when fence is in position
45° "signmaker's" router bit
1/4"-20, 2 1/2"-long screw for fence adjustment

Shelf side. *A strip of tapped hardwood holds a screw that moves the table up and down.*

Trim-router side *The back simply needs to accommodate the trim router in position.*

V-cut. *Lower the platform to center the point of the bit on the workpiece, then cut the mating Vs on each piece. Note the push stick/support to the left; I use that to push the piece across the cutter.*

gauge at 1/8" thickness. Once properly thicknessed, each of the parts should be cut to exact length: 7/8" for the center shaft and 7/16" for the arrowhead.

I make these cuts at the table saw using a thin-kerf blade, a zero-clearance insert, a crosscut guide with a plywood fence and a stand-off block.

Clamp the router jig securely to your bench. Position its table and extend the bit just enough to bevel half the thickness of a test piece. Then turn it over and bevel the other side. This should create a perfectly centered point without reducing the size of the workpiece. Adjust the setup until you're satisfied – it's important that the cut be perfectly centered for the pieces to nest properly.

Then, run one end of each arrowhead and center shaft sections.

To make the mating cut, drop the router jig's table down until the bit makes a centered V-cut on the other edge of each piece. The cuts should fit perfectly – one neatly into the other.

To glue up the arrow banding, mill two strips of 1/16"-thick maple for the outer layer, place one piece face up on a caul atop your benchtop, and coat it with yellow glue. Then simply alternate the placement of the arrowhead and center shaft sections onto the wet glue. Push the sections together firmly, eliminating any gaps.

Now glue on the second maple strip.

Check everything for alignment, then clamp up the lamination using your benchtop and a stout caul to provide even pressure.

Of course, all of these bandings must be dressed on a sander or with a handplane before ripping them for use in a project. For maximum yield, I recommend ripping at the band saw, and to a thickness of 1/16". That's thin enough so that the strips will obediently follow a curve – but not so thin that they'll come apart as you use them.

And that's it – you now know how to make banding in three designs for use on the dressing mirror or any build you like. Now take the techniques you've learned here and try out a couple of designs of your own. **PWM**

Mario is a long-time furniture designer, maker and teacher. He now offers classes at the Philadelphia Furniture Workshop.

A perfect match. *With the V-cuts centered on both pieces, they'll mate perfectly.*

Nested. *Alternate arrowheads and center shafts as you glue the pointed pieces to the outer maple strip. (The clamping caul underneath is covered in packing tape to keep glue from sticking to it.)*

Caul & clamps. *With the two outer strips sandwiching the arrowheads and center shafts, place a caul on top and clamp everything to your benchtop until the glue dries.*

ONLINE EXTRAS

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ARTICLE: *"Soup Up a Veneer Saw," by Mario Rodriguez.*

ARTICLE: *Learn how to make "Diamond Banding."*

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Micro Marco

BY CHRISTOPHER SCHWARZ

Marco Terenzi is a toolmaker and furniture maker with a talent for incredibly tiny work.

Toolmaker Marco Terenzi has a dream shop that sounds a little bit like a nightmare from "Alice in Wonderland."

It's a typical shop with a workbench, tools and machines. But there's a little door down in the corner. If you get down on your knees, open the door and stick your head through, you'll be in an exact quarter-scale replica of the full-size shop, and it's fully functional. Everything is tiny but it works.

"And that's when my parents said 'no, no, no, stop, stop, stop,'" Terenzi says with a laugh. "My parents tell me I need a girlfriend."

Since Terenzi was about 6 years old, he has spent just about every waking moment in his parent's basement, building things out of wood and metal. He started as a typical young woodworker making pens and scrollsawn decorations. But then his work took a turn for the small, and now he dedicates a lot of his time to making quarter- or 10th-scale woodworking tools, workbenches and tool chests – all of them fully functional.

His work has attracted attention all over the world for a couple reasons. First, no matter how close you get your eyeball to his work, it still looks full-scale. Second, he's only 25 years old.

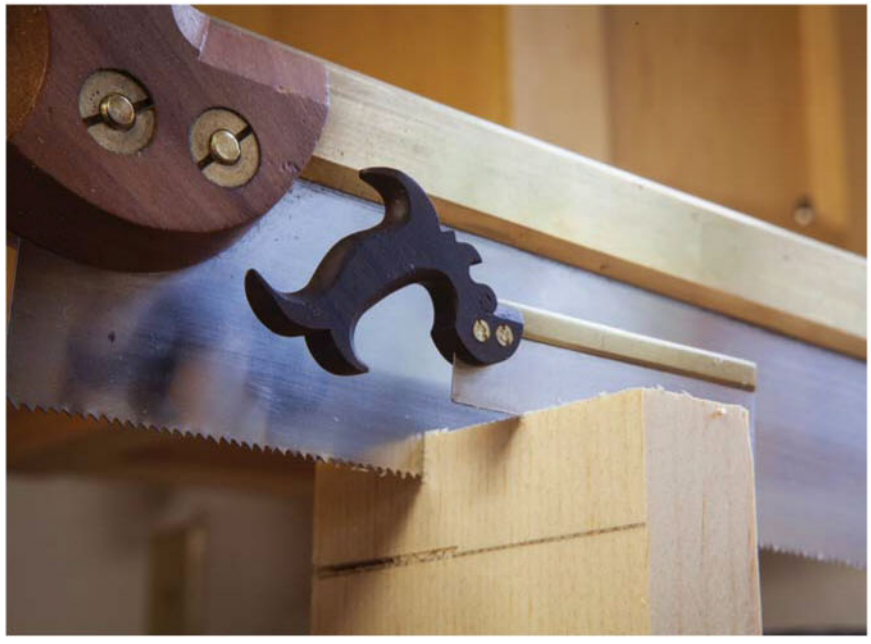
Crazy from Fumes

The story of how Terenzi became such a proficient maker at such a young age started when, as a very young boy, he asked his parents for a soldering iron and began taking apart all his dad's electronics. With that soldering iron – his first tool – he began melting the solders on the circuit boards and took them apart.

"My dad thinks that was what made me crazy – all the lead fumes from that soldering," Terenzi says.

But really, what makes him "crazy" (to use his parent's word affectionately) is an obsession with process. Terenzi

Working small. *Marco Terenzi's miniatures are completely functional. This quarter-scale Lie-Nielsen No. 62 plane works. The iron is hardened A2 steel. The depth adjuster works. And the mouth opens and closes – just like on the full-size tool.*



Just like its big brother. *Terenzi's miniature saws cut (very smoothly, I should add). They have to because he uses them to cut miniature dovetails when he builds miniature tool chests.*

picks up a plastic ketchup bottle on the table at a restaurant and points to the marks on the bottom that show how the bottle was released from the machine after it was extruded.

"How was this made?" he asks. "When I'm in the shower, I look at the mill swirls on a shampoo bottle and can see they used a cheap die to make it because I can see the swirl marks. This is what I'm doing when I'm supposed to be taking a shower.

"Some days it's like a total curse. I don't want to think about (process) it, but I just can't help it."

His obsession led him to drag a picnic table into the basement of his parent's suburban Detroit home (when he was about 8) where he began building and turning things from wood.

He made about 100 pens – selling some and giving some away – until he perfected the process and became bored by it.

"Pens are a no-brainer," he says. "You have only this small space for any creativity. The rest is all done for you. The only way I'd do another pen is if I had a rose engine lathe and I could make the metal parts."

He turned to scrollsawing and spent hours following plans, making anything he could find in woodworking magazines and books. When he reached the limits of that process, he moved on to more complex things. But he doesn't regret the countless hours he spent at the lathe or scrollsaw.

"I just sat there day after day, scrolling and scrolling," he says. "It was like meditation for me. After a while you just follow the line without knowing it. But it really develops your hand-eye coordination and that has served me well.

"I've never been one for video games or TV. I knew what I wanted to do."

A Detour to Art School

While in high school, Terenzi took some engineering courses, but quickly fell into the fine art world. After some students from Detroit's College of Creative Studies visited his school, Terenzi decided to pursue a crafts degree from that institution.

There he was introduced to blacksmithing and even got to make Damascus steel. And there he began making full-scale art furniture. His parents'

The beginning. *Terenzi began woodworking by turning pens and anything else he could fit into his Delta midi lathe.*

The full-size shop. *Terenzi has been working in this basement shop since he was 8 or 9, but he's getting ready to move to his brother's farm where he'll have more space.*

PHOTOS BY THE AUTHOR EXCEPT CHILDHOOD PHOTO, COURTESY OF MARCO TERENZI

The first mini. *Terenzi's miniature hammers shipped in tiny boxes. Collectors and woodworkers snapped them up. I've even seen people who take them on trips with them. (The nail? That's for scale.)*

home is still decorated with many of his pieces, which combine metal and wood into work that has both organic and industrial components. The base of one of his pieces, for example, looks like an egg that is made from foundry components.

And while Terenzi still wants to make full-size furniture (more on that in a bit), at art school he became obsessed with something new: high-tolerance fits of parts. In school he was learning to work with metal, but there was a casualness to the blacksmithing work he didn't like.

"It's like a game of: How accurate can you make it?" he says. "Each one has to be better than the last."

After college he considered selling his furniture – he had student loans to pay – but he was leery about trying to sell his work to galleries, which can take 50 percent of the sale price of a piece.

And he thought it would be tough to find customers in the Detroit area who would appreciate his furniture's industrial look.

So he decided to make something that people could more easily relate to and turned to making miniature tools.

An Instagram Sensation

But how do you sell miniature tools? Terenzi has a web site (marcoterenzi.com), but that's not enough to find customers. So one day while he was working in the shop, he decided to take a photo of what he was working on and put it on Instagram, a social media site where people share photos with short captions.

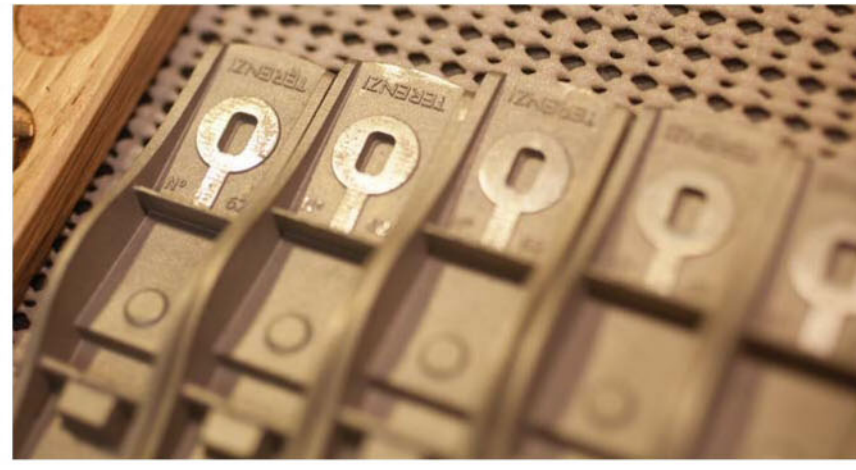
"It allowed me to get my work out there without ever leaving the house," he says. "Everything I sell is through Instagram."

You can see his work at instagram.com/marcoterenzi (you don't have to sign up to see photos) – or you can sign up and follow his work, like almost 17,000 others have. That's a huge following for a toolmaker or woodworker – Lie-Nielsen Toolworks, by comparison, has 8,000 followers.

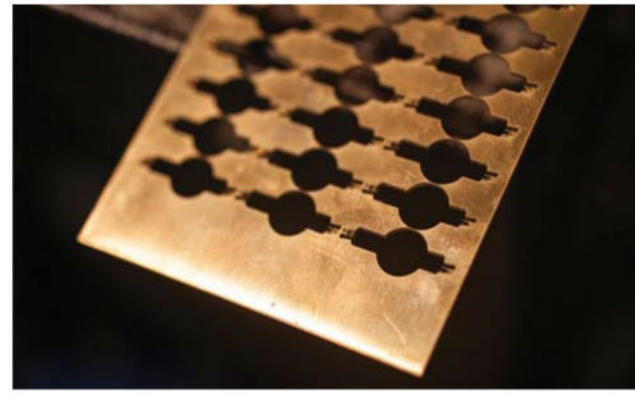
His first product was making miniature engineer's hammers, which he shipped in a handmade miniature box made with miniature nails (that were driven with a miniature hammer). For some of the first orders, he even included a miniature receipt. And, even more important, he made his first student loan payment with money from selling his hammers.

He made miniature saws (which he uses to cut miniature dovetails), plus scribing tools – both full-size and tiny.

During most of 2015, Terenzi visited other makers of miniatures and embarked on his most ambitious project: making quarter-scale versions of the



Tiny castings. *Shown here are some of the quarter-scale white bronze bodies that Terenzi will mill into working bevel-up jack planes.*



Little material. *One of the advantages to working in such a small scale is that you don't need a lot of material – just good material. Here are a whole bunch of mouth adjusters have been cut from a piece of metal no larger than your hand.*

Tiny saw. *Terenzi's miniature table saw sits on top of his full-size one (note the parts for a miniature sawbench stacked on top of the table).*

Lie-Nielsen No. 62 bevel-up jack plane.

He pushed himself to learn a lot of new techniques to make the tools, including modeling the project in CAD to use 3D printing. He's also been seeking out other miniature makers to learn new skills – including Paul Hamler.

Hamler is one of the most well-known and skilled miniature toolmakers (he also makes full-size tools). When he travels, he carries his work with him in a now-famous briefcase. When he opens it, middle-aged men swoon over it like it is full of diamonds.

Inside are dozens of functioning miniature tools that Hamler has made – plow planes, routers, braces, scrapers, spokeshaves and on and on.

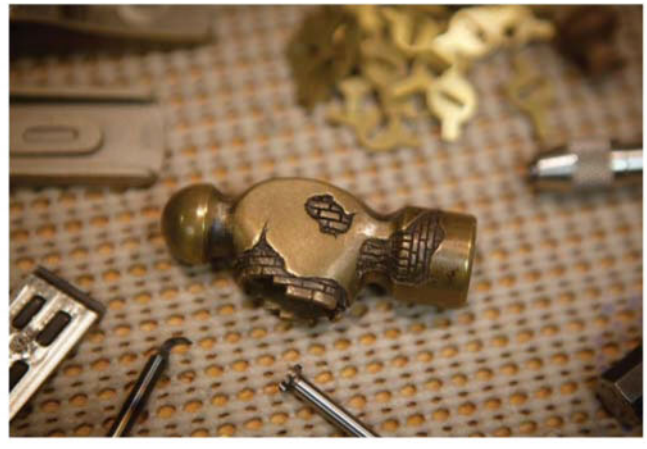
After Terenzi attended Woodworking in America in North Carolina in 2014, he called Hamler to see if he could visit his Georgia workshop.

Hamler readily agreed and Terenzi spent five days working in Hamler's shop, sleeping in the shop so he could be closer to the work and work at all hours.

"We have a sofa bed," Hamler says. "I gave him the choice of staying in the house or to stay in the shop. He chose to stay out there. I told him: Nothing is off-limits. You can open any drawer you want to, any book or whatever.

"I don't know who was the tiredest when he left – me or him."

Hamler was impressed.



Part art. *Some of Terenzi's tools incorporate the industrial aspect of his furniture pieces, such as this miniature hammer head, which is on the shelf above his workbench.*

"Some days it's like a total curse. I don't want to think about (process) it, but I just can't help it."

—Marco Terenzi

"He was doing stuff that took me 10-15 years to learn to do," he says.

But Hamler says he hopes Terenzi doesn't burn out.

"I've always believed what we learned at IBM: You need a balance between work and family," Hamler says. "He's burning it at both ends."

Terenzi, who works until 3 a.m. at times, says he'll never burn out.

"I will never leave this," he says. "I will leave this when I'm dead. It's the only thing that toots my horn."

More Dreams

While Terenzi says he will continue to make miniature tools, he has other ideas on the drawing board – some of them influenced by his dream of a tiny shop inside a full-size one.

One idea is a table that has a compartment. Inside that compartment is a tiny scale model of that table. Or perhaps a full-size tenon saw with a handle that flips open to reveal a miniature tenon saw.

But then he also has dreams of oversized tools.

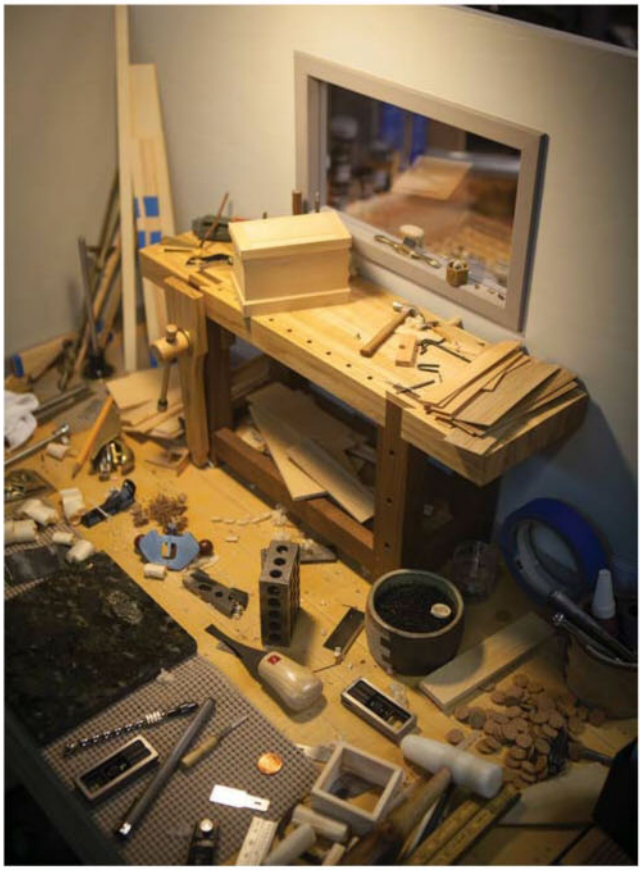
"Like a No. 62 that is so heavy you can't even pick it up," Terenzi says. "A 400-pound ball-peen hammer with a telephone pole for a handle. Super-big stuff that would make me feel small."

And while woodworkers might think it odd to make tools in disproportionately small and huge sizes, Terenzi says he simply sees them in his head and wants to make them.

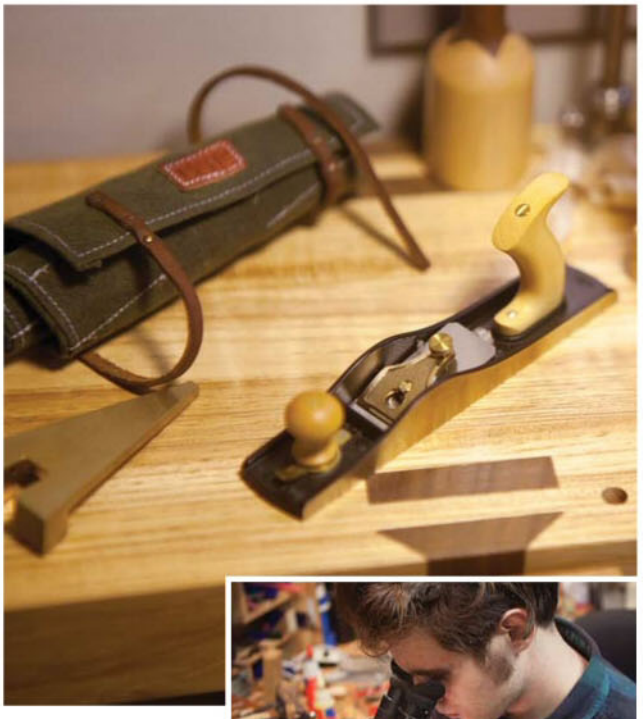
The miniature No. 62 plane started out as a vision so strong that Terenzi could see the thing in his hand.

"The last three months have been to make it so that other people could see what I saw," he says. "To me these aren't even miniatures," he says. "They are full-scale. Normal." **PWM**

Christopher is the editor at Lost Art Press and author of the forthcoming "The Anarchist's Design Book."



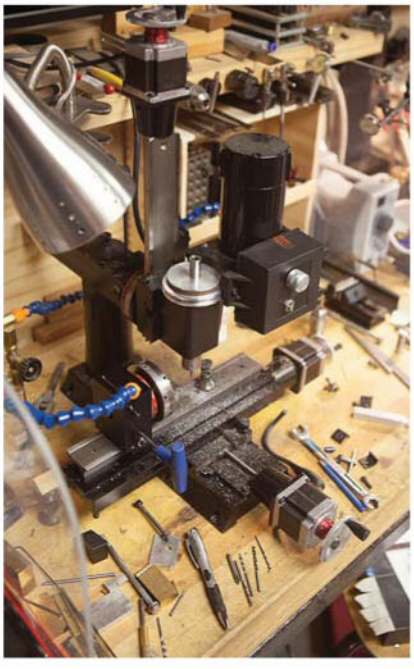
That's a small shop. *Terenzi has built part of a miniature shop in his full-size shop that includes a French workbench and a traditional tool chest under construction.*



On the bench. *Above is shown one of the in-process No. 62s on Terenzi's miniature bench. Note the miniature tool roll made by Texas Heritage Woodworks.*

A close look. *For some operations Terenzi uses this magnifier to examine or work on parts. Sometimes you can get too close, he says, and start working on details that the naked eye cannot see.*

In the rough. *Here's a few cast lever caps that need to be finished and tapped for his jack planes.*



Milling machine. *Luckily, there are machines for model makers that Terenzi can use for his scaled-down work.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/feb16**

WEB SITE: *Visit Marco Terenzi's web site.*

ONLINE: *See Terenzi's work on Instagram.*

BLOG: *Read Paul Hamler's blog on miniatures.*

IN OUR STORE: *"The Art of Carving Netsuke," by Peter Benson.*

Our products are available online at:

- **ShopWoodworking.com**

Bow Shelves

BY BRUCE WINTERBON

Delicate 'hyperparabolas' hang on a curve – then hang 'magically' on the wall.

When I saw a photo of a set of three rectangular shelves supported by a bow near each end, my reaction was that the bows deserved better shelves. These shelves are the result.

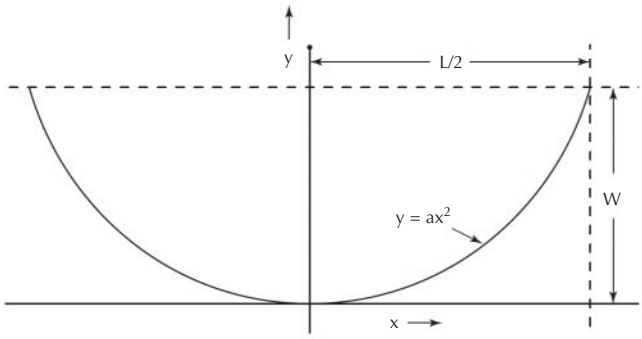
The shelves are seemingly floating on the wall with no visible means of support, so I'll quickly explain the "tricks." The backs of the shelves are supported by French cleats. The bow is made from bent laminations. The upright – the "bowstring" – is notched to fit over each cleat, and a slot is cut in each shelf to fit around it. Each joint – shelf to bow and bow to upright – is pinned with a short piece of 1/8" drill rod or steel rod from the home center.

The tops of the shelves are at about eye level, so it's pointless to use highly figured wood; all you see are the edges. I've used both ash and cherry to make sets of bow shelves. Shown here in the step photos is cherry; the opening photo is a set of ash shelves.

These shelves are intended to display treasures, not to hold a printed encyclopedia set. They are light, and I wanted them to look light. The shelves are thick at the back to accommodate the French cleats, and thin at the front to lighten the appearance. The upright "string" at the back needs some strength, especially where it is notched to rest on the cleats. Its front edge is rounded. The bow needs to be wide at the ends to go around the upright, but narrow at the center. Everything but the shelf backs and upright are curved, and all the visible edges are rounded.

But the curves don't stop there – the shelf fronts? A circular arc is too boringly uniform, and a parabolic shape for the shelves is too pointed – so I played with the parabola. A parabola is defined by the formula $y=ax^2$ with x measured

PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY DAN PESSELL & DONNA R. HILL FROM THE AUTHOR'S DRAWINGS



Parabolas. *a= w/(L/2)^2*

Shelf layout. *By gluing together matching boards, I'm able to lay out my three shelves on one piece, then cut them apart at the band saw.*

along the length from center, **y** is the depth of the shelf at that point, and **a** is a scaling factor.

Using a spreadsheet ("Plot Your Course"), I experimented with different values for the exponent 2 and looked at the shape of the curve on a resulting graph until I found a value I liked. A value of 2.5 looked best to my eye. (Note: The "hyper" in the title stems from this: A "hyperparabola" is a parabola with a higher exponential dimension than 2.)

The curves of the bow, both the bend and the narrowing at the center, are too shallow for the shape to be important; I used a parabola for the bend. The center shelf will be attached near the middle of the bow; choose where the bow and shelf will meet. I used 8⅝". (We'll find the crossing points for the small shelves later.)

When viewed from the front, the bow is wider at the ends than at the center (the last spreadsheet column shows the negative space). Any smooth curve will do, but as with the bend, I chose a simple parabola.

Note: If you are making patterns from the spreadsheet calculations, I argue it is easier if you work in millimeters or decimal inches. A 12" machinist's rule with one side graduated in 10ths and 100ths is not expensive, nor is a dial caliper that reads in thousandths of an inch. Since I bought a dial caliper, I use it almost as much as my tape measure. I keep a table of decimal equivalent fractions hung up in a convenient place in my shop.

The dimensions in the spreadsheet include the 9/16" width of the cleat. One can either (allowing for the kerf width) rip the cleat pieces off the back of the shelf, or rip the cleats from a separate piece of wood. Then, make the shelves narrower to attach the cleat to the back.

On the Shelves

So that the grain and color match at the front edges, I glued up a panel that allowed me to lay out all three shelves on one piece. After the glue dried, I cut them apart at the band saw, leaving "ears" on either end to accommodate planer snipe. Go ahead and joint the back edge of each shelf in preparation for gluing on its cleat.

I cut the French cleats – 9/16" wide by about 1" thick (¾" plus room for the kerf, and for planing to final size) – for each shelf out of wood that matches the shelves.

At my table saw, I ripped each cleat at a 35° angle instead of the usual 45° to give the relatively thin cleats additional strength, especially at the narrow edges.

Glue the upper part of each cleat to its shelf. Instead of clamps, I use 1" finishing nails, drilling clearance holes in

PLOT YOUR COURSE

Hyperparabolae y=a*power (x,p) for shelves

	large	small	bow bend	bow sides*
halflength	16	9.875	21	23.5
width	11	6.75	8.625	0.375
exponent p	2.5	2.5	2	2
scale factor a	0.01074219	0.02202729	0.01955782	0.00067904

large shelf		small shelf		bow bend		bow sides	
position x	width	position x	width	position x	width	position x	bow sides
0	11.00	0	6.75	0	8.63	0	0.38
1	10.99	0.5	6.75	1	8.61	2	0.37
2	10.94	1	6.73	2	8.55	4	0.36
3	10.83	1.5	6.69	3	8.45	6	0.35
4	10.66	2	6.63	4	8.31	8	0.33
5	10.40	2.5	6.53	5	8.14	10	0.31
6	10.05	3	6.41	6	7.92	12	0.28
7	9.61	3.5	6.25	7	7.67	14	0.24
8	9.06	4	6.05	8	7.37	16	0.20
9	8.39	4.5	5.80	9	7.04	18	0.15
10	7.60	5	5.52	10	6.67	20	0.10
11	6.69	5.5	5.19	11	6.26	22	0.05
12	5.64	6	4.81	12	5.81	23.5	0.00
13	4.45	6.5	4.38	13	5.32		
14	3.12	7	3.89	14	4.79		
15	1.64	7.5	3.36	15	4.22		
16	0.00	8	2.76	16	3.62		
		8.5	2.11	17	2.97		
		9	1.40	18	2.29		
		9.5	0.62	19	1.56		
		9.875	0.00	20	.80		
				21	0.00		

*As seen from front

the cleat and pilot holes in the shelves. After the glue dries, temporarily attach the wall half of the cleats to their mates with hot glue so they can be planed as parts of the shelves.

To plane each shelf's underside 3/8" thinner at the front than its back, attach a 3/8" batten to the top face of the shelf near its front edge. Make sure the battens are at least as long as their respective shelf piece (including the remaining "ears"). I use hot glue for the temporary attachment. Then run the shelves upside-down through the planer to reduce their front edges to 3/8" while leaving the rear edges a full 3/4".

Pop off the battens and wall pieces of the cleats, then band saw each shelf to its final shape; clean up the curves using your preferred method and tools. (I used a spokeshave, followed by sandpaper.)

Now cut off the last inch or so of the wall piece of each cleat, and glue those to their mates at each edge of each shelf. This will help to disguise the hanging mechanism when the finished shelves are installed.

Knock down the sharp edges of all the cleat pieces so they will fit together easily, then put the shelves aside.

Add a Bow & Its 'String'

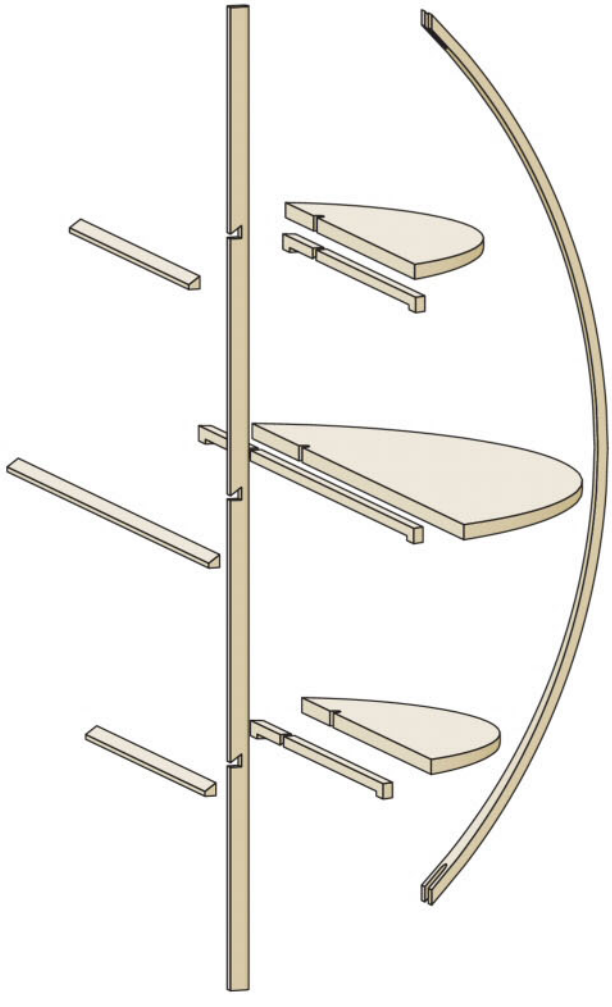
Cut and plane the upright (the bow's "string") to 1/2"-thick x 1" wide, but leave it a few inches overlong for now. (Once it is shaped, that excess will be cut off for a gauge.) Then round the front edge either by hand or with a router bit, and move on to the bow.

The finished width at each end of the bow will be 1 1/2", so the lamination strips must be wider than that; I look for a piece of stock 1 3/4" to 2" wide. For the strips that make up the bow lamination, choose a straight-grained piece of wood at least 54" long, and make a diagonal pencil mark on its edge so the strips can be easily reassembled in order for grain matching.

Cut strips for the bow. I do this at the table saw, and cut them thick enough to plane away all the saw marks for a finished thickness of 1/8". The bow is laminated from four strips, but cut a couple extra to allow for breakage, and so that you can use one (or more) as a clamping caul.

Surface both faces of each strip, running them through the planer on a pine sled.

The curve is gentle enough that only a male bending form is required. Mine is made from two 3/4" thicknesses of particle board, a bit longer than the bent length of the laminations, glued and screwed together.



EXPLODED VIEW

Ready to plane. *Here's the largest shelf, shown upside down with the "ears" still intact. Both halves of the cleats are attached at the back, and the 3/8" batten is attached at the front to the top surface with hot-melt glue.*

Less conspicuous. *By gluing in place the last inch or so on each end of the wall half of the cleat, it will help hide the cleat when viewed from the side once the piece is on the wall. (In this picture, the ends still need to be flush cut to the shelf's curve.)*

Bow Shelves

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	
❑ 1	Large shelf	3/4	11	32	Cherry	
❑ 2	Small shelves	3/4	6 3/4	19 3/4	Cherry	
❑ 1	String/upright	1/2	1	48	Cherry	
❑ 1	Bow	1/2	1 1/2	54	Cherry	overlong
❑ 3	Cleats	9/16	1	*	Cherry	

*Match length to shelves

Safe planing. *These narrow strips are too thin to plane without running them through the machine on a sled. Note the horizontal cleat at the leading edge for the power feed to grab.*

Curved & clamped. *Begin clamping the four-piece lamination (plus one extra strip as a caul) at the center and work your way out toward each end.*

Smooth & fair. *After cutting the curves on the side of the bow at the band saw, fair all the curves. I use hand tools for this operation.*

Mark the form at the ends and center of the bow-to-be, and mark the laminations at their centers. Cover the form with strapping tape to keep glue from sticking to it.

But before reaching for the glue, do a dry-assembly. Using an extra lamination strip as a caul, start clamping at the center and work toward the ends.

Now take it apart and start over, this time with glue. I use Titebond III for its 10-minute open time – but don't dawdle.

Run a bead down the center of one strip, put the next one against it and rub them together, then separate them and add glue to any dry spots.

Put the four strips plus the caul together flat, then place them as a bundle against the form, matching the center lines, and start clamping from center to ends.

When the glue is fully set, unclamp the bow. Joint one side, then run it through the planer until the two sides are smooth and parallel.

Put it back on the form to mark the center and ends, then band saw off the excess length, and drill a 1/8" hole at the center.

The curve of the sides of the bow is so gentle that any smooth curve will look like any other. I marked every 2" along the bow from the center and laid out the parabola using my spreadsheet. (Because we're laying this out on a curved surface, it's not technically a parabola – but the curve looks no less pleasing to my eye. If this makes no sense to you, just ignore it – you can use your eye rather than math.)

> "Beauty: it curves, curves are beauty."
>
> —*James Joyce (1882-1941), Irish writer*

Cut the curves at the band saw, then trim the ends to length. Now smooth all the surfaces and round the edges. I do this at a shaving horse, using planes and spokeshaves before sanding all the surfaces to #150 grit.

Put it All Together

Remember that overlong bit on the upright? Cut off that excess length to use as a gauge as you fit the bow and shelves to the upright. Clamp pieces of wood, as shown below right, to your bench to overcome the small amount of springback as you hold the bow at the desired length (43 5/8" in this case); this jig should allow the upright to fit into the bow while it holds the bow.

Scribe one end of the gauge to fit the inside curve of the bow where the upright will go.

Then use the gauge to mark the cutout on each end of the bow through which the upright will pass.

When the slots in the bow are cut (I do this with a backsaw and refine the cuts as needed with gouges and a round rasp), fit it over the upright and, with the bow held in its final position, drill a 1/8"-diameter hole through the bow and upright at each end.

Use 2"-long standard spiral nails as temporary pins; they slip in and out easily, and the heads are easy to grasp. Grind the points off for safety. You'll use one of these blunted nails as a drift pin at final assembly for driving the pins in the last little bit (or for driving them out).

Mark the backs of the upright and bow to show which way they go together, and mark the top end of the bow with masking tape.

With the bow in its jig and the upright removed, use the hole drilled in the center of the bow to locate and drill a corresponding 1/8"-diameter x 7/8"-deep hole in the large shelf. The bow can touch the front of the shelf, or the shelf can be notched to fit against the bow.

Mark the spot for the pin for the other two shelves. I prefer to put it in the same place, proportionally, as on the big shelf.

The shelf lengths used here are 19 3/4" and 32", so use a square to find the distance from the end of the big shelf (here that's 7 3/16"), and multiply that by the above ratio (to get 4 7/16"). Put the shelves

Multi-gauge. *The offcut from the upright is used as a gauge at both ends of the bow, and to mark the back of each shelf, for the slots that will fit over the upright.*

Temporarily pinned. *Spiral nails hold the shelves in place to the bow after 1/8"-diameter holes have been drilled in both. (A jig holds the bow at the correct curve; the tape marks the top end.)*

Angled slots. *Cut 35° slots (to match the angle of the cleats) in the upright.*

in place and drill 1/8"-diameter holes through the bow, letting the drill bit's point poke through far enough to mark the hole locations in each shelf. Pull the shelves out and drill their holes to 7/8" deep (or slightly deeper) as with the large shelf.

Lay out the slots in the back edge of the shelves where they meet the upright (again, use the offcut as a gauge, but now using the squared end), and cut the slots.

Next, mark the upright where the cleats meet it, and cut slots in it as shown above.

The slots must be cut at the angle of the cleat (35°); they will show underneath the shelf – but no one will ever see them without looking for them.

Write on the back of the upright the spacings between corresponding points on the notches. You'll need those spacings when you attach the cleats to the wall.

Now dry-fit the entire assembly, again using the spiral nails, to make sure you're satisfied with how everything goes together.

Now take it apart and apply your chosen finish. I typically use a wiping varnish to allow the natural grain and color to show.

Cut five 1 3/8"-long pieces of 1/8"-diameter drill rod. (That's just short enough to not be conspicuous joining the bow to the upright.) Slightly chamfer the ends of each piece of steel.

Pin the bow to the upright, then pin the shelves to the bow. (Should you ever need to take it apart, separate the bow from the upright first, then remove the shelves from the bow.)

Final fitting. *Before applying a finish, dry-fit the entire assembly to ensure it all goes together as planned.*

To securely hang your finished shelves, the cleat for the large shelf should (ideally) cross two studs.

Draw a line on the wall for the center shelf's cleat. Draw the two other lines, spaced according to your measurements, for the smaller shelves.

I also put lines on the cleat at the shelf opening for the upright, then draw a vertical line on the wall for one side of the upright. That and the three horizontal lines should define the cleat positions.

Drill and countersink screw holes into the cleats, then secure them to the wall.

You might need to notch the shelf parts of the cleats to go around the screws.

I rely on the stiffness of the steel pins and the friction of the shelves on the upright to hold the assembly together while I set it in place. Then I breathe again. **PWM**

Bruce is a woodworker and retired physicist who lives in Deep River, Ontario.

Tap it. *Use one of the blunt nails as a drift pin as you tap the steel into place.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/feb16**

PATTERN: *Download PDF patterns for the shelves.*

ARTICLE: *For another shelving take on hanging curves, read "Bent Laminations."*

PLAN: *Download the SketchUp model for this project from our SketchUp Warehouse.*

IN OUR STORE: *"Design & Techniques for Building Curvy Furniture," a video by Jeff Miller.*

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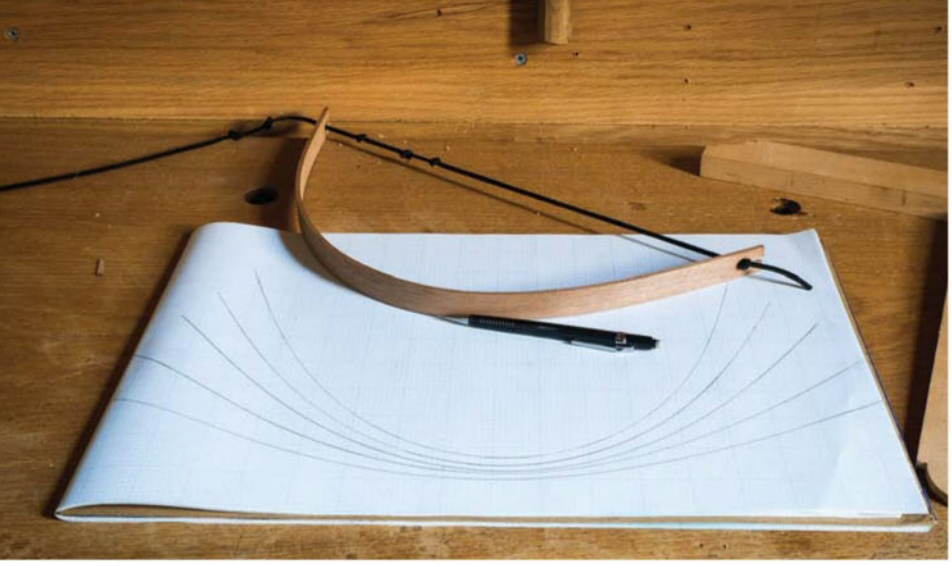


Nice Curves, No Math

BY RANEY NELSON

Mechanical solutions for the formula-challenged woodworker.

There was a time when I was fairly good at math – but that was back when "personal" and "computer" were two words you'd never expect to see together. A few decades later, I often find it difficult to multitask long enough to add two numbers together, while also remembering why I added them in the first place.

So even though I am still capable of most shop mathematics – at least briefly, after my sixth cup of coffee – I tend to opt for mechanical and visual solutions when they're viable.

Fortunately for us muddle-headed sorts, there are methods for laying out curves that will more than adequately approximate the lovely forms generated by (admittedly awesome) higher-dimensional parabolic equations, as demonstrated by Bruce Winterbon in his "Bow Shelves" article (page 48).

Here are three I have made use of in my shop.

Bow Method

This method (shown in the opening photo) is probably the most commonly used technique for laying out fair curves on furniture. It's certainly the one I use most often. The basics are simple: First, find a sturdy form that bends elastically (that is, it springs back when released). Fortunately for woodworkers, thin strips of wood fill the bill nicely.

I most often use 1/8" x 3/4" strips of straight-grained hardwood, anywhere from 18" to 48" in length. At either end, I cut a small slit to fit a piece of string or twine, and knot the ends of the string to hold the curve I want.

Mathematically, these curves (called an "elastica") are not at all simple, but Mother Nature does all the calculation, and the resulting curves are quite visually pleasing.

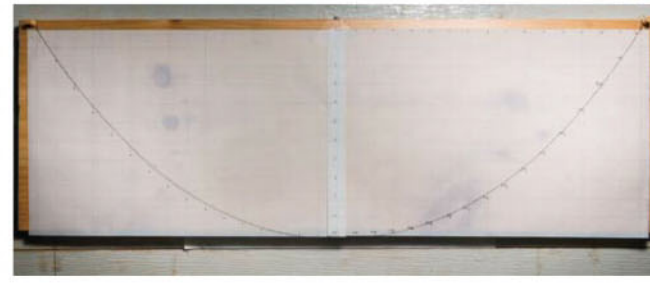
Be aware that variations in the thickness of the wood will alter the shape, which can be quite useful for varying the curves. By selectively thinning the wooden bow it's easy to vary the rate of curvature fairly significantly. The thinner an area of the bow is, the more sharply it curves. Taper the bow from one end to the other, and you'll shift the "peak" of the curve to get a beautifully faired non-symmetrical shape.

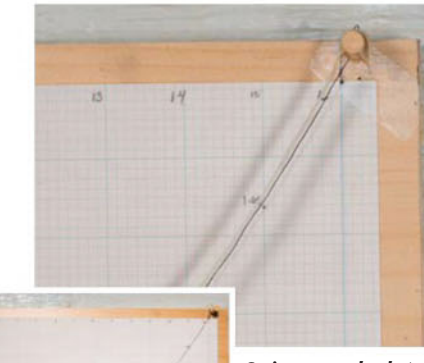
A few minutes of experimentation with a handplane are all it takes to be hooked on these devices and their flexibility (pun somewhat intended).

To best approximate the curve given by the "hyperparabolic" calculations to make the "Bow Shelves," the bow should be tapered at either end, increasing the degree of curvature at the endpoints.

Jump-rope Method

I don't find this method quite as convenient as the bow because it can only be done vertically, but it's as simple to do. Just hang a piece of rope or string between two posts and let it dangle. This is the shape seen in suspension bridges, jump-ropes and Christmas





Strings attached. *A jump rope or thread can be hung from two points to generate a catenary. Note that the pins used here are located outside my working curve.*

PHOTOS BY THE AUTHOR

"Whatever creativity is, it is in part a solution to a problem."

—Brian Aldiss (1925-), English author

tree lights hanging from eaves. While the shape looks very much like a parabola (which you may remember from geometry class), it is technically known as a "catenary," and it is a more complicated mechanical function. Still, visually it's a very minor difference, and this is an excellent and simple way to generate a nice curve.

There are two things to be aware of when creating a catenary.

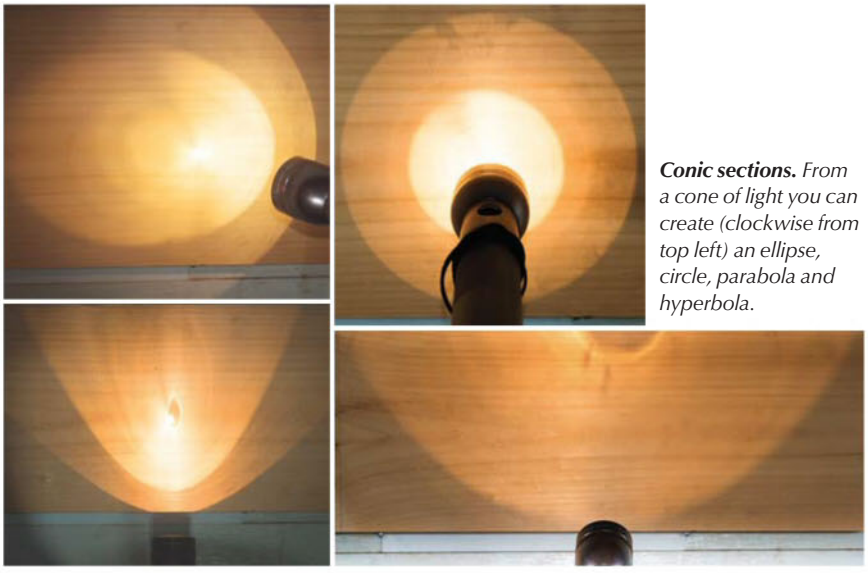
First, the string used needs to be as close to perfectly flexible as you can find. Strings with any "memory" at all (meaning they retain a bend) will not hang well. The two materials I've had the most success with are (of course) a good quality jump-rope and simple sewing thread. Both will give you quite good curves.

Second, there is inevitably some distortion of the curve near where it joins the post. This problem is most easily dealt with by making sure the posts themselves are outside the area of the curve.

As you can see in the photos on the previous page, the thread catenary I made is actually a fairly good approximation of the hyperparabolic curve. It's not perfect, but it's close enough that I was quite happy with the results. This is probably the method I'd use for this particular project.

Cone-of-light Method

The four curves we probably see most often in woodworking – the ellipse, the circle, the parabola and the hyperbola – are collectively known as the "conic sections." They earn this name because all four can be made by the intersection of a plane and a cone. Imagine, if you will, a samurai slicing a birthday hat (maybe he hates aging – I don't know). If he slices the hat generally horizontally, the opening in the top will be an ellipse, or the special case known as a circle if the cut is exactly parallel to the hat's base.



Conic sections. *From a cone of light you can create (clockwise from top left) an ellipse, circle, parabola and hyperbola.*

If the samurai cuts the hat in a generally vertical direction, though, he'll produce either a hyperbola or a parabola (unless he splits in clean through the point, but we'll ignore that possibility). A cut that's exactly perpendicular to the hat's base will result in a hyperbola. A cut that's off-vertical will produce a parabola.

None of this really matters especially, unless you're at a birthday party with samurai, but it does allow a very simple way to reproduce these curves in the shop. Rather than stock a supply of multiple-sizes of birthday hats, though, simply use a beam of light to make the cone. And rather than cut it with a sword (because you can't, even with a katana), just use a convenient flat surface as a plane.

Simply take a flashlight (or any light source with a circular shield) and project it onto a wall. If you project it more or less straight at a wall, the beam of light will form an ellipse. If you aim it exactly perpendicular to the wall, the ellipse will be a perfect circle.

Now aim the light closer to parallel to the wall. As the beam glances off the wall, it will generate a parabola. If you place the light very close and aimed exactly parallel to the wall, it will generate a hyperbola.

Note that this method has one significant disadvantage: It's tricky to hold a flashlight at a precise orientation and trace the resulting curve at the same time. When I've used this method, I do it with a flashlight mounted on a photographic tripod. If you don't have a tripod, you can use an inexpensive clamp-on shop light instead of a flashlight. Just make sure it has a round surround.

One last bit of advice before you go out and generate a million curves: While all of these methods theoretically generate perfect forms, in the real world that is almost never the case. There are small variations in materials, positioning etc.

As a general rule, whenever I'm making a symmetric curve of any kind, I copy only half of the wood bend, catenary or light image. Then I copy that half of the curve to make a perfectly symmetrical other half.

See? Nothing to fear here. Other than samurai parties, anyway. **PWM**

Raney is an infill planemaker and woodworker at Daed Toolworks. He lives near Indianapolis, Ind.

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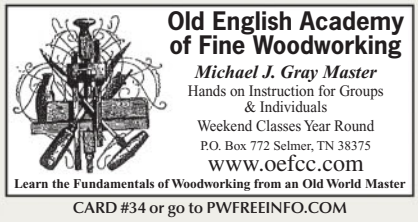
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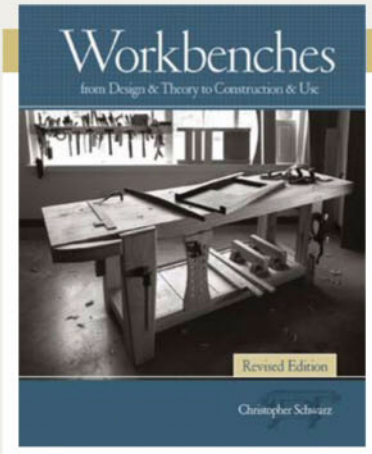

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Furniture: It's Meant to be Used

In some contemporary households, 17th-century style storage prevails.

I once sold a chair to a woman who later told me how much she loved it. "I never let anyone sit in it!" she exclaimed, apparently to show me how special it was to her.

I told her that was about the worst thing she could say to me.

In my home we use our furniture hard. Stuff the chests 'til they just barely shut – that's our motto. That's where we store our off-season stuff. Our old house has only one proper closet, so we rely on the chests to do their duty. You can fit an extraordinary amount of clothing in these chests.

But another feature, sometimes a curse, of a good joined chest is that the lid is a large expanse of flat space. If it's an oak lid, it's a large, hard-wearing flat space. That means it collects things sitting on its lid. The one shown (below with stuff all over it) is 54" x 21". A kid can fit a lot of Legos on that kind of platform. I also usually always store a large box on top of a chest. I avoid putting a small box on top of that – there's a limit even for me. I have seen antiques dealers display them that way. Ugh.

One thing I really want to know is how these objects were used originally. To do that, we need to get a look into the houses of those who lived in the period – and who doesn't like snooping around in people's houses?

Contrived. *Just to show how awful it looks to display a box-on-a-box-on-a-chest, I shot this photo. I then immediately rearranged things to a more tasteful order.*

Early on, I was taught about the wonders of probate inventories. These are records made of a person's "chattels" at the time of their death. In the 17th century, these inventories could sometimes be quite detailed, other times rather sparse. The best type of probate inventory is a "room-by-room" inventory. In this example, the appraisers went from one room to the next and listed the goods found in each. In my early research, I pulled out just the furniture or tools. The values are listed in old English currency, 12 pence (*d*) to a shilling (s), 20 shillings to a pound (£).

Meant for use. *The lids of my furniture pieces serve many purposes…all of which involve piling stuff on them.*

Period Inventories

Joan Harris died in Essex, England, in 1638:

- In the hall: One table one forme & one stoole 9s; 3 chayres 1s6*d*; one cubbord 9s; 2 bench boards and other implements 1s
- In the parlor: One joyned bedsteddle... one cubbord, one chest 17s; one joyned chest, one wicher chaire 9s;
- In the chamber over the parlor: one joyned chest, 2 boorded chests, one box £1.

PHOTOS BY THE AUTHOR

Simple. A two-room house, with "chambers" above each.

One flaw in my early research is that I didn't copy the whole inventory. This example tells us what furniture Harris had, but nothing of its context.

Charity Blages, widow of Richard Blages, "a gentleman," died in Devon, England, in 1628: Among her many possessions were "A truncke a presse two Chestes with other smale Coffers" worth 50 shillings.

Being all lumped together like that makes it impossible to learn any distinction about these pieces. But the next listings were "Shetes table Cloathes & other naperye" valued at £5. Then came "Fether bedes Ruges Coverlettes Pyllowes bolsters and blanckettes" appraised at £15. And last in this listing was "Her wearing apparell" at £13 6*s* 8*d*.

All of these textiles coming right on the heels of a cluster of case furniture leads us to assume they were stored in the furniture.

You see patterns like this in period inventories frequently. Keep in mind that we're talking about houses without closets, so the chests were the primary place to store textiles. It always pains me to say it, but the contents of the chests were more valuable than the chests themselves. Textiles, both clothing and linens for the table, were the work of many hands, whereas woodwork often was the work of one individual, at most maybe two men.

Once upon a time. *This 17th-century chest from New England had a till, but no more. All that remains are the notches for the till's side and bottom, and the mortise for the lid's hinge.*

My (Imaginary) Inventory

I've never done it, but I often think about what an inventory of my house would look like.

In the living room: one joined chest carved and painted, one board chest, one chest of drawers and four carved boxes. There's some typical contents and some non-traditional examples. Part of it might read, "One large carved box, with scarfs, mittens, hats, one small carved ditto with candles, batteries and phone chargers."

Twice a year, maybe three times, we make plans to "go into (this or) that chest." It's quite an ordeal. You have to clear off the top, which means the stuff piled there has to go somewhere. If you don't plan well, that somewhere is the floor, which then makes it hard to get around. Best be prepared and find a spot for that stuff.

When you open the chest lid, you can prop it up by swinging the till lid open, and leaning the chest lid on it.

It beats holding it open with your head – until the till breaks. Often on old chests, all that remains are the notches that indicate there was a till.

Then you pull out the upcoming clothing, and stash the outgoing. There's always detours; you stumble on things forgotten ("I didn't remember these photos were in here!"). That can lose you some hours, so it's best to do this when you don't have to be somewhere.

We once had a cat that would jump into the chest anytime we opened it. Whatever did happen to that cat? **PWM**

Peter has been involved in traditional craft since 1980. Read more from him on spoon carving, period tools and more at pfollansbee.wordpress.com.

If it fits.... *Much of our furniture still functions as it did traditionally. This large box stores woolens in the main section, and small household items in the till.*

ONLINE EXTRAS

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- **popularwoodworking.com/feb16**

BLOG: *Read Peter Follansbee's blog.*

ARTICLE: *"The Best Oak Money Can't Buy."*

About this Column

ARTS & Mysteries

"Arts & Mysteries" refers to the contract between an apprentice and master – the 18th-century master was contractually obligated to teach apprentices trade secrets of a given craft (and the apprentice was expected to preserve those "mysteries").

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My Sanding Block

Efficient, cheap and simple to make.

This magazine puts a lot of emphasis on hand tools – that is, tools without motors. Common subjects include handplanes, chisels, scrapers etc. But when it comes to sanding, it seems that most people use random-orbit sanders. These have motors! Why not sand by hand, also?

I love sanding by hand. Sure, I own pad, belt and random-orbit sanders, but I rarely use them. On large projects, I'll sometimes spend 10 or 15 minutes with a random-orbit sander to get a rest and relieve the boredom. But that's it. I'm quickly back to hand-sanding because I find it faster. It's also more efficient because I never get "squigglies," which are so prevalent with random-orbit sanders. I also enjoy the aerobic exercise.

The biggest downside of hand-sanding is working up a sweat and dripping on the wood. Drips can cause darker spotting under a stain or finish if the sweat-induced raised grain isn't totally sanded out.

Sanding blocks. *This solid cork sanding block from Denmark (right) was the model for my own wood and cork block (below).*

Alternatives

When hand-sanding a flat surface, you should always back your sandpaper with a flat block. Commercial sanding blocks, usually made from hard rubber or plastic, are widely available, but these blocks are very wasteful of sandpaper. You don't use all the grit.

Increasingly popular with woodworkers are rectangular sanding blocks with sandpaper on four sides around a hard core of foam. These aren't wasteful of sandpaper, but they are considerably more expensive than sheets of sandpaper. So they are wasteful of your money.

Also, you are more limited in the sandpaper types and grits from among which you can choose than you are with the wide variety of types and grits in sheet form.

So instead of using these wasteful and limiting products, I make my own sanding blocks from softwood with 1/8"-thick cork glued to the bottom. I modeled this block after the solid cork blocks that everyone used when I worked in Denmark in the mid-1970s.

Sanding Block

Here's how I make the sanding block.

I shape a piece of softwood (pine or fir) to 1 1/4" thick x 2 3/4" wide x 3 7/8" long. You could adjust these dimensions slightly if needed to comfortably fit in your hand. But keep in mind the efficiency of these measurements when it comes to the use of the sandpaper.

If you want a little more heft, you could use a hardwood.

I then glue 1/8"-thick cork to one face using PVA (white or yellow) glue, cutting the piece of cork slightly larger than the final dimensions to allow for slippage. I've found cork sheets of this thickness at craft stores and auto-parts stores (sold as gasket cork).

Finally, I trim the excess cork and chamfer the top of the block so it fits more comfortably in my hand.

There's no need for a finish, and one would be counterproductive anyway because most finishes become gummy after extended contact with skin and sweat.

Efficiency of Design

Someone in Denmark must have put a lot of thought into the design of this sanding block because it is so efficient.

Take a standard 9" x 11" sheet of sandpaper and tear it in thirds crosswise. (You could cut it with a knife or scissors, but you will quickly dull the tool and it won't be faster.)

I don't measure the thirds. I merely fold one side of the sandpaper to about

CONTINUED ON PAGE 62

PHOTOS BY THE AUTHOR

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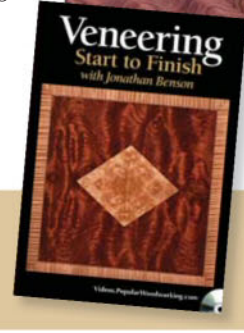

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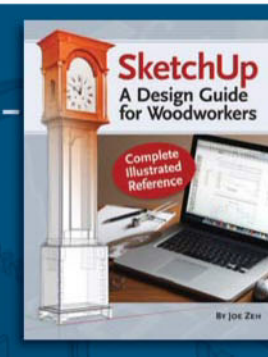

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CONTINUED FROM PAGE 60

Folding & tearing. *To create the proper size of sandpaper for use with the sanding block, fold the sandpaper into thirds across the width, crimp the edge with your thumb and index finger, then tear it. Finally, fold, crimp and tear the remaining two-thirds in the middle.*

Gripping sandpaper. *To get maximum use of the sandpaper with the sanding block, fold a third of the sandpaper sheet in half lengthwise and wrap it around the sanding block so there's just enough of the two-flap side to grip with your fingers. When you have worn that face of the sandpaper, flip it and use the opposite face.*

Use it all. *After wearing both opposite faces of the sandpaper dull, wrap the sandpaper around the sanding block and use the middle face.*

Without sanding block. *An added beauty of this system of using sandpaper efficiently is that you can easily convert back and forth from sanding flat surfaces with the sanding block to sanding three-dimensional surfaces without the block.*

the midpoint of the remainder, then crimp the fold with my fingers. Then I fold the paper back on itself (breaking the stiffness) and tear it. Finally, I fold the remaining two-thirds in half and tear it again.

Simple; Fast

I then take one of the thirds, fold it in half lengthwise and wrap it around the cork side of the sanding block, holding it in place with my thumb and fingers. I use my fingers to hold the edge with the two flaps and my thumb to hold the edge with the fold. I wrap the paper so the edge with the two flaps rises up the side of the block just enough for me to get a grip. This part of the sandpaper will be the only part that is wasted, so I want to minimize it.

Also, by keeping this part minimal, enough of the folded side is left to give me three entirely separate surfaces from one-third of a sheet, or nine surfaces total from one sheet of sandpaper.

When I have sanded with one of the surfaces until it becomes dull or clogged, I flip the sandpaper and use the opposite side of the fold, holding the sandpaper in the same manner. When I've sanded that side dull, I open the folded paper and wrap it around the block to use the middle third, the third with the fold in it.

I can't think how you could make more complete use of a sheet of sandpaper.

When sanding surfaces clamped between bench dogs on my workbench, I often use both hands, placing one on top of the other. Of course, there is no right- or left-handedness to the block, so I can also use either hand individually.

I have several of these sanding blocks (easier to find that way) and I use them interchangeably for sanding wood and sanding finishes, including sanding up to #600-grit or finer with wet/dry sandpaper and a lubricant. It's easy to remove dust or sludge by knocking the block against the workbench or wiping with a cloth. You could, of course, have separate blocks dedicated to each type of operation.

A further advantage of this system is that I can use the same third-of-a-sheet of sandpaper to sand efficiently without a block. I simply fold the third-of-a-sheet in thirds again, and flip the outer faces to use a full 100 percent of the sandpaper. By having grit against paper on one of the inside folds, rather than paper against paper, as occurs when you fold sandpaper in half, the "pad" of sandpaper holds together better and makes sanding much easier. **PWM**

Bob is the author of "Flexner on Finishing," "Wood Finishing 101" and "Understanding Wood Finishing."

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Reverence

Respect for tools was the real lesson I learned from a woodworking icon.

My introduction to Japanese woodworking started with Toshio Odate's underwear.

"My tools are like my underwear. You wouldn't touch my underwear, so don't touch my tools," Odate told me and my classmates.

So began my first exposure to Japanese woodworking tools and techniques in a shoji screen-making class led by the renowned artist. I had little interest in shoji screens, but I had a keen interest in learning from a master. Although 15 years have passed since that experience, the many lessons learned during those few days have remained with me.

The Master's Voice

Odate apprenticed as a woodworker in post-World War II Japan, moving to the United States in 1958. He extended his artistic skills as a sculptor, and his teaching skills as a professor and author. His book "Japanese Woodworking Tools: Their Tradition, Spirit and Use" (Linden) is one of my prized possessions.

The class taught us many things. We learned how to make an inkwell and pen from a bamboo shoot, glue from rice flour and how to produce gleaming planed pine surfaces that required no finish. Odate's demonstrations gave us insight into the uncanny economy of movement, space and materials characteristic of Japanese woodworking. During my time in the shop, I developed an appreciation for the genius and refinement of Japanese woodworking tools, and the comparison and contrast with Western tools and techniques.

Odate's expert eye diagnosed our problems, ranging from improper posture to sloppy sharpening. His abrupt, straight-talk feedback gave us a glimpse into his apprentice days.

After slicing my fingers from the sharp corners of a Japanese mortise chisel so many times that my white pine risked turning red, I casually commented that I had heard that one should ease the corners with some sandpaper. Odate himself turned red at the thought of defiling a tool in this manner, then carefully explained the role of the corners of the chisel in the mortise-making process.

Honoring the Process

The demonstrations showed the speed, accuracy and grace that can come from hand-tool techniques combined with decades of careful practice. However, what seemed effortless while viewing it was of course more difficult in practice.

Beyond tools, Odate shared many stories about the hard life of an apprentice woodworker in Japan, made harsher by his master – his own stepfather.

Beyond the end product, the job of the "shokunin" (craftsman) also required respect for the customer, the materials, the process and the tools.

Although many of Odate's memories harkened back to a tough past, some of his stories were touching, too. For example, the smell of the camellia oil he used to protect his tools reminded him of his mother, because she used that oil in her hair.

Odate 's tools are works of art. Laid out before us for display and photographs, their patina portrayed years of hard work and attentive care. These tools were not simply ordered from a Cyber Monday web site, but were carefully acquired after significant savings, reflection and patience.

High-quality tools only came after years of honing hard-won skills. And, just like good underwear, a good tool (no matter how worn) is rarely discarded. **PWM**

Brad is a Minnesota-based woodworker and professor of software engineering.

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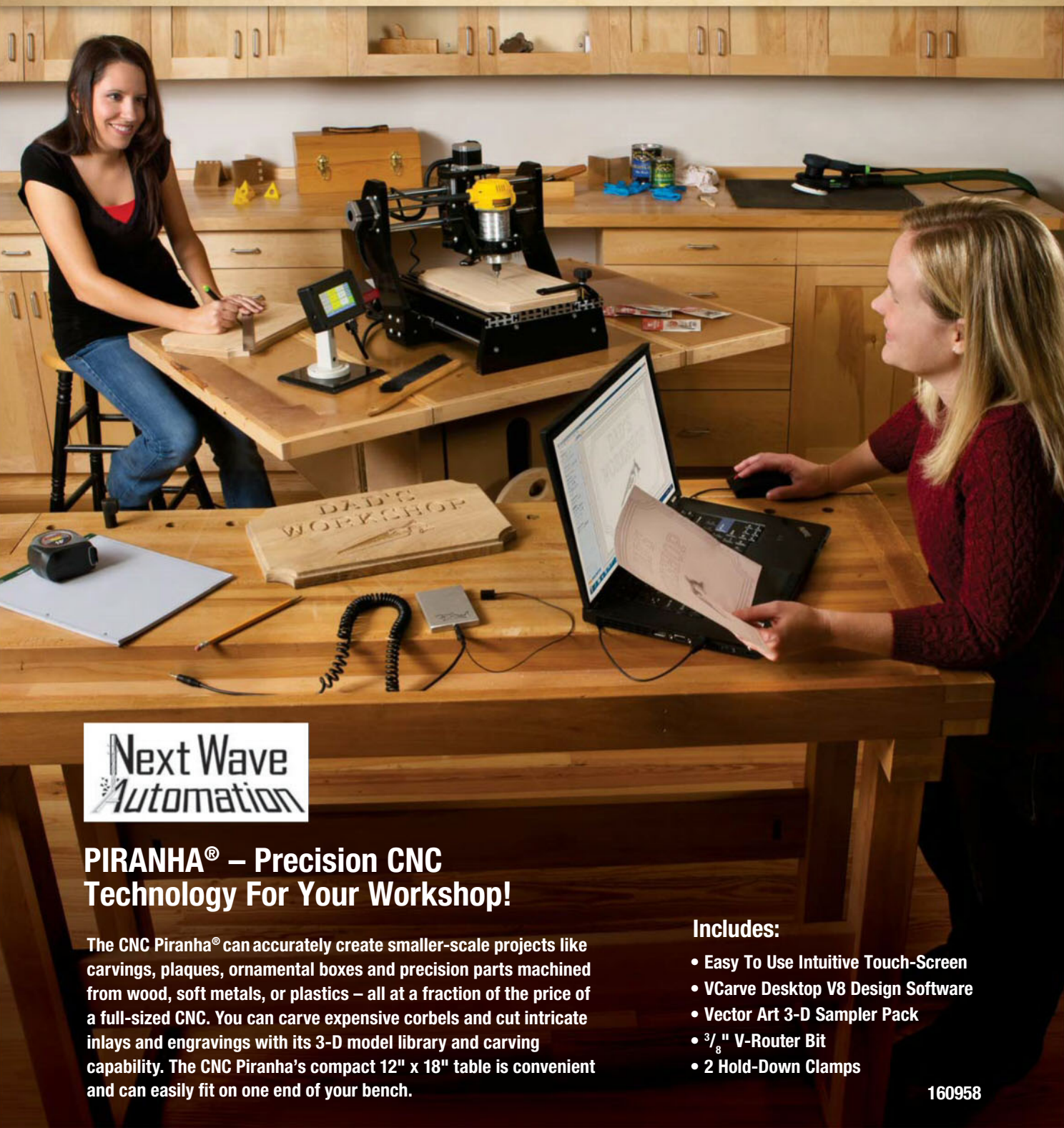

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